(2)

AN EVALUATION OF NAVY ENLISTED RATINGS SUSPECTED TO BE AT GREATEST RISK FOR NOISE INDUCED HEARING LOSS

NEHC TECHNICAL REPORT

AN EVALUATION OF NAVY ENLISTED RATINGS SUSPECTED TO BE AT GREATEST RISK FOR NOISE INDUCED HEARING LOSS

Published By

NAVY ENVIRONMENTAL HEALTH CENTER
2510 WALMER AVENUE
NORFOLK, VIRGINIA 23513-2617

DECEMBER 1990

Reviewed and approved in accordance
with SECNAVINST 5600.16A

CAPTAIN J.J. EDWARDS, MC, USN
Commanding Officer

TABLE OF CONTENTS

BACKGROUND

The Naval Hospital, Great Lakes identified to the Chief of Naval Operations (CNO) (1) a problem of enlistees with existing hearing loss being assigned, or in some cases enlisting under contract to be assigned, to enlisted ratings where they would routinely be exposed to hazardous levels of noise. NAVHOSP Great Lakes correctly expressed concern that such assignment would create the potential for aggravation of the pre-existing hearing loss. NAVHOSP Great Lakes suggested that assignment of individuals with hearing loss to ratings that involve routine exposure to noise places these individuals at a greater risk for developing a communication handicapping hearing loss prior to the completion of a typical Navy career.

The inadequacy of current assignment procedures was identified by a study conducted by their Occupational Health/Preventive Medicine Audiology staff. This study screened hearing tests of approximately 35,000 recruits entering active duty at the Recruit Training Center, Great Lakes. Of the recruits screened, 450 individuals, or less than 1.28 per cent, were selected for analysis based on having a pre-existing hearing loss of 30 dB or greater in two or more frequencies in at least one ear. A significant percentage, 80 per cent, of these enlistees were scheduled to receive additional training for entrance into ratings their staff considered to be potentially noise hazardous. NAVHOSP Great Lakes suggested changing or, if necessary, creating hearing standards for those enlisted ratings which would expose individuals to potentially hazardous levels of noise. This action, it was rationalized, should ensure enlistees with pre-existing hearing loss are not allowed to pursue career fields which would likely result in additional hearing loss. Additionally, their staff recommended medical waivers not be granted for individuals whose career intentions are for those ratings which would routinely expose them to hazardous noise.

The Naval Hospital, Great Lakes recommended to the CNO via Commander, Naval Training Center, Great Lakes; Chief of Naval Technical Training; and Chief of Naval Education and Training that a formal study be conducted to determine which Navy enlisted ratings should be classified as having the greatest potential for developing noise induced hearing loss. All activities in routing strongly endorsed the recommendation that changes be made in the classification process so as not to lose the service of senior enlisted personnel due to hearing loss.

The CNO requested the Chief, Bureau of Medicine and Surgery (BUMED) conduct a feasibility study to identify Navy ratings exposed to significant noise hazard during a typical career (2). BUMED assigned the Navy Environmental Health Center (NAVENVIRHLTHCEN) to assist.

The design of this preliminary review and survey was patterned after an evaluation conducted by the Naval Aerospace Medical Research Laboratory (NAMRL) (3), published in 1978, titled "Prevalence of Hearing Loss Among Selected Navy Enlisted Personnel." NAMRL obtained hearing threshold data on eight ratings considered to be routinely noise exposed, on eight ratings which were felt to be relatively noise free, and on four apprentice groups. Threshold data were obtained in each rating for eight length of service categories ranging in one-year intervals through four years of service and at five-year intervals thereafter through twenty to twenty-five years of Naval service. Audiologists and highly trained and motivated technicians collected threshold data by actually conducting hearing tests on individuals identified in each rate for each length of service category.

The NAMRL study is considered the most reliable source of accurate information concerning the status of hearing loss among selected enlisted ratings in the Navy. However, it required data collection in over eighteen geographic areas and took over three years and literally thousands of man-hours to accomplish. It was felt that the current evaluation needed to be more time and resource sensitive.

The purpose of this review was to determine if there are identifable Navy enlisted rates for which exposure to hazardous levels of noise results in significant loss of hearing over the course of a career.

METHOD

The NAVENVIRHLTHCEN distributed a survey letter (4) to all Navy Audiologists worldwide requesting they provide information, based on their clinical experience, on which enlisted ratings most frequently were referred for hearing evaluation or demonstrated hearing loss felt to be caused by noise exposure. A listing of those ratings suspected to be at greatest risk for developing noise induced hearing loss during a typical Navy career was developed from their input (Table I). The ratings identified represent a diversity of groups ranging from Deck, Ordnance,

Aviation, to Miscellaneous ratings. Also of interest, the eight ratings considered to be the most exposed to hazardous noise in the study conducted by NAMRL were also identified by the Navy Audiology community in this survey.

This listing of ratings for study was forwarded to the Enlisted Personnel Management Center (EPMAC) (5) for identification of individuals in each rating for five length of service (LOS) categories: 1 to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, and those with 20 or more years of service.

No attempt was made to control for sex or race, even though these factors may influence susceptibility to noise induced hearing loss (6). The effect of this lack of control is unknown, but is suspected to be limited at least for sex bias. This suspicion for lack of sex bias is based on restriction of females for certain ratings. Review of the data indicate relatively few females were selected for study.

The request identified 14 different search locations and requested identification of 30 service members in each LOS for each rate evenly distributed across all search locations. An attempt was made by EPMAC to search only non-deploying activities and to search for individuals not expected to rotate in the near future. The author's intent was to gather data for at least 25 individuals in each LOS for each rating. Difficulty was anticipated in achieving a 100 per cent return rate for each LOS category for each rate.

EPMAC was able to identify a total of 3490 individuals within the search parameters. EPMAC provided a listing containing the name and social security number of individuals by rate and LOS for each search activity. This list was forwarded to the 14 medical activities identified as providing support for the service member for data collection (7). Hearing threshold data for the earliest and most recent hearing test was recorded on a data sheet provided (Appendix A).

As noted in the NAMRL evaluation, and as is widely documented (8,9), hearing loss resulting from exposure to hazardous levels of noise affects the higher frequencies before spreading to the lower frequencies. The focus of the current evaluation was analysis of hearing thresholds in the higher frequencies of 3000 Hz through 6000 Hz.

TABLE I

Navy Enlisted Ratings Suspected At Risk

Rate	Title
AB	Aviation Boatswain's Mate Basic
ABE	Aviation Boatswain's Mate (Launching and Recovery Equipment)
ABF	Aviation Boatswain's Mate (Fuels)
ABH	Aviation Boatswain's Mate (Aircraft Handling)
AD	Aviation Machinist's Mate
AM	Aviation Structural Mechanic Basic
AME	Aviation Structural Mechanic (Safety Equipment)
AMH	Aviation Structural Mechanic (Hydraulic)
AMS	Aviation Structural Mechanic (Structures)
AO	Aviation Ordnanceman Basic
AW	Aviation Anitsubmarine Warfare Operator Basic
BM	Boatswain's Mate Basic
BT	Boiler Technician Basic
BU	Builder Basic
CM	Construction Mechanic Basic
EN	Engineman Basic
EO	Equipment Operator Basic
GS	Gas Turbine Systems Technician Basic
GSM	Gas Turbine Systems Technicina (Mechancial)
GM	Gunner's Mate Basic
GMG	Gunner's Mate (Guns)
GMM	Gunner's Mate (Missiles)
HT	Hull Maintenance Technician Basic
MM	Machinists's Mate Basic
MR	Machinery Repairman Basic
MU	Musician Basic
PM	Patternmaker Basic
RM	Radioman Basic
ST	Sonar Technician Basic
STG	Sonar Technician (Surface)
STS	Sonar Technician (Submarine)
WT	Weapons Technician

RESULTS

Approximately 2450 of the data forms were returned. Six per cent of the data forms received had to be discarded due to missing, incomplete, or, in some cases, repetitive data; i.e., the earliest and most recent hearing tests were the same data for individuals with multiple years of service. Data for 2310 individuals, a response rate of 66 per cent of those identified, were entered into a data base for evaluation.

Listed in Table II is a breakdown of the numbers of individuals in each length of service category by rate. There are few individuals for those rates for which there are multiple subgroups within each rate. For example, the Aviation Boatswain's Mate (AB) rating is broken down into three subgroups. These are for those working in the ares of: 1) Launching and recovery equipment (ABE); 2) Fuels (ABF); and 3) Aircraft and handling (ABH). Individuals in the AB rating are grouped into the rating subgroup in which they have received their training and experience. However, those in this rating lose their subgroup designator above the pay grade of E-7. This same procedure happens at varying pay grades for the ratings of Aviation Structural Mechanic (AM), Gunner's Mate (GM), Gas Turbine System Technician (GS), and Sonar Technician (ST). For this reason it is not surprising to find few, if any, individuals in the lower LOS categories. The analysis of data for these subgroups was combined at the LOS category of 20+ years. Additionally, ratings which require extensive technical training may account for fewer numbers of individuals in the earlier LOS categories.

Also listed in Table II are ratings which were not requested from EPMAC for analysis. It is the author's understanding that EPMAC identified specific billets for individuals within ratings for this study. In some cases individuals from like ratings may actually be assigned to the billet. For example, a billet may be identified for a Gunner's Mate. In certain situations, this billet may be filled by others with like background, such as Torpedoman's Mate or Missile Technician. Additionally, there were insufficient data for analysis for the ratings of Construction Mechanic Basic (CM), Weapons Technician (WT), Gas Turbine System Technician (Electrical) (GSE), and Equipment Operator (EO) for the 15-19 and 20+ year LOS. The EO rating was evaluated in the NAMRL study. This rating was found to have the greatest prevalence of hearing loss of all the rates evaluated.

There was no clinical significant difference when comparing the left ear data to right ear data. Therefore, left ear and right ear data were pooled.

TABLE II

Numbers of individuals for each Rate in each Length of Service (LOS) category

	LOS					
RATE	1-4	5-9	10-14	15-19	20+	TOTAL
AB	1	1	1	3	4	10
ABE	25	28	23	11	3	90
ABF	9	15	17	10	2	53
ABH	20	16	16	15	4	71
AD	31	27	27	28	17	130
AM	1	1	1	18	20	41
AME	11	29	19	14	3	76
AMH	23	31	23	28	14	119
AMS	26	30	29	28	15	128
AO	19	27	27	20	12	105
AW	21	21	25	20	16	103
BM	12	27	25	16	14	94
BT	12	21	19	18	17	87
BU	28	18	16	17	9	88
CM	14	21	8	7	3	53
EM	0	1	0	2	1	4
EN	20	22	20	18	11	91
EO	18	20	15	6	3	62
EW	0	0	3	4	0	7
GM	0	1	18	21	17	57
GMG	2	23	12	14	0	51
GMM	2	20	11	1	2	36
GS	0	0	4	11	4	19
GSE	0	2	0	0	1	3
GSM	13	22	22	18	2	77
HT	15	27	20	20	7	89
MM	22	27	22	23	13	107
MR	16	22	16	15	6	75
MU	34	42	13	18	13	120
RM	16	24	15	20	10	85
ST	0	0	1	1	2	4
STG	3	20	16	17	8	64
STS	0	30	23	19	7	79
TM	1	1	1	0	1	4
WT	7	7	5	4	5	28
TOTAL	422	624	513	485	266	2310

Listed in Table III are the mean time intervals between the earliest and most recent hearing test. Beginning at the 10-14 year LOS, this interval is reduced. This was the result of inadequate documentation of the earliest hearing test. It was not uncommon for individuals in later LOS categories to have hearing test history dating back only 10 years. The result of this may inappropriately mask the true level of hearing at the time of entry into a rating for these individuals.

A depiction of hearing thresholds for each length of service category for the ratings evaluated is provided in Appendix B. The data reflected in these figures indicate hearing thresholds almost routinely get progressively worse as length of service increases, with the greatest amount of hearing loss occurring in the frequencies of 4000 and 6000 Hz. Only one enlisted rating, Musician (MU), did not demonstrate hearing thresholds in excess of 20 dB in at least one frequency by the 20+ years LOS.

Listed in Table IV are frequency analysis data for 3000 through 6000 Hz for the 20+ LOS across all rates. Again, from these data, it would appear that the MU rating is the only rating not at risk. Following the MU rating in the lesser degree of risk are the Radioman (RM) and Sonar Technician (ST) ratings. This may be intuitively expected based on typical noise exposure.

An analysis was performed to determine if those whose earliest hearing thresholds exceeds the generally excepted value for normal hearing of 25 dB would demonstrate more hearing loss than those whose hearing was less than 25 dB. The frequency of 4000 Hz for the left ear was chosen to best represent degree of hazard. Six per cent of individuals with normal hearing demonstrated progression of hearing loss to 40 dB at this frequency. Twenty-four per cent, or four times as many, of those whose earliest hearing thresholds were greater than 25 dB had progressed to 40 dB.

CONCLUSIONS

The current survey does not demonstrate the degree of high frequency hearing loss as was previously demonstrated by the NAMRL study. For example, the MM rating in this evaluation averaged hearing thresholds of 23 dB at 4000 and 6000 Hz. In the NAMRL evaluation, hearing thresholds for this frequency ranged in the same LOS of from 41 to 46 dB. The same tendency for current hearing thresholds to indicate less loss of hearing holds true

TABLE III

Mean Time Interval Between Earliest and Most Recent Hearing Test

Length of Service	Mean (Standard Deviation)
1-4 years	2.2 (2.3)
5-9 years	5.8 (2.6)
10-14 years	9.3 (3.8)
15-19 years	12.6 (6.3)
20 + years	14.2 (6.4)

TABLE IV

Statistical Data for 20+ LOS by Rate

RATE: MEAN: STANDARD DEVIATION: RANGE:	# SUBJECTS	3K	4K	6K
AB (ALL)	9	12.78 7.21 0-25	17.56 11.90 0-45	22.00 13.04 0-65
AD	17	21.00 10.93 0-80	35.12 17.45 0-85	31.41 17.18 0-80
AK (ALL)	52	22.58 15.96 0-80	29.46 19.91 0-85	31.50 21.07 0-85
AO	12	24.67 18.61 0-70	34.42 23.81 0-85	33.33 20.69 0-90
AW	16	17.25 9.77 0-50	33.13 20.09 5-85	39.19 22.31 5-90
BM	14	15.57 12.34 -5-40	21.86 13.68 -5-50	25.86 19.87 -5-75
BT	17	14.82 10.21 0-45	19.29 12.52 -5-70	25.35 16.81 -5-85
BU	9	14.22 10.87 0-40	28.78 20.86 5-70	28.11 15.41 5-60
EN	11	13.00 9.65 0-40	22.18 14.82 0-60	26.45 21.93 5-90
GM (ALL)	19	20.74 12.51 -5-75	33.00 20.37 0-85	35.89 21.67 0-90
HT	7	15.43 6.45 5-30	19.71 8.32 5-40	24.57 10.15 10-50
MM	13	19.77 16.17 0-75	23.08 18.92 0-80	23.31 9.78 5-50
MU	13	11.46 7.92 -5-25	16.15 9.43 5-40	19.31 13.20 0-45
MR	6	17.33 9.44 5-35	29.83 12.43 5-55	29.83 16.20 15-65
RM	10	12.00 9.13 0-35	21.60 13.93 0-55	28.80 15.24 5-70
ST (ALL)	17	16.00 16.36 -5-45	20.82 16.83 0-55	26.41 20.41 0-75

for the AB rating, with 25 to 39 dB versus the current 13 to 22 dB, and for the EN rating, with 29 to 40 dB versus 13 to 26 dB. It is unclear whether this trend toward lower hearing thresholds is a result of improved hearing conservation efforts in the last 12 to 14 years, or if it is the result of the limited numbers of individuals in this evaluation when compared to the NAMRL study. Additionally, compounding the comparison is the possibly that higher hearing thresholds were the result of the previous study actually capturing the data, whereas the current evaluation relied on data reported from that available from health records.

This data gathering effort indicates reliance on hearing tests conducted prior to the early 1980s are often poorly documented. The DoD Hearing Conservation Forms introduced in the early '80s have standardized the Navy's documentation to control noise induced hearing loss. These forms now allow accurate tracking of the hearing status of Naval personnel throughout their Navy careers. Unfortunately, what they all too often document is the progression of noise induced hearing loss without intervention.

Tremendous improvements have been made in the Navy's hearing conservation efforts in recent years. Resources in personnel and equipment have expanded manyfold in the past twenty years. For example, at the first Navy Hearing Conservation Institute held in Annapolis during July 1977 there were a total of approximately fourteen audiologists employed by the Navy; now there are approximately fifty. Trained and certified audiometric technicians were then rare; now we train more than 900 per year. Until recent years, an individual could enlist in the Armed Services with total hearing loss in one ear and a minor hearing loss in the remaining ear. Enlistment standards have recently been changed (10) so as to not allow individuals whose hearing is outside what is considered to be normal limits to be enlisted.

As we have made improvements in other areas, it is now incumbent upon us to reduce the risk of further hearing loss from those who, while meeting enlistment standards, currently exhibit hearing loss at the time of their enlistment. Whether the hearing loss currently demonstrated indicates a susceptibility for noise induced hearing loss or is the result of some form of ear disease, the potential for suffering additional hearing loss in typically noise exposed rates is too great at the present time to allow entry into enlisted rates where noise exposure is routine. The effect of this restriction should not be burdensome. The report from the Naval Hospital, Great Lakes would indicate that only about 1 per cent of all enlistees may be affected.

SUMMARY

The purpose of the current evaluation was to determine if there were specific Navy enlisted ratings which resulted in hearing loss due to noise exposure. The data from this evaluation suggests at least the following rates are at risk: AB (all subgroups), AD, AM (all subgroups), AO, AW, BM, BT, BU, EN, EO, GM (all subgroups), GS, HT, MM, MR, RM, and ST. Individuals with hearing thresholds averaging 25 dB or greater in the frequencies of 3000 through 6000 Hz with no one frequency exceeding 40 dB should not be allowed to enter these rates.

The present evaluation was restricted to those ratings where the typical noise exposure was suspected to cause hearing loss. It became evident during the analysis of this data that noise exposure of the remaining ratings may also place them at risk. The Navy Medical Department will continue the current effort to identify other Navy enlisted rates which may also be at risk for noise induced hearing loss.

REFERENCES

1. CO NAVHOSP Great Lakes ltr 6260 Code 037 Ser:3466 of 21 Nov 89

2. CNO ltr 6260 Ser 136E1/OU578072 of 15 Mar 90

3. Robertson, R.M., Page, J.C., and Williams, C.E., "The Prevalence of Hearing Loss Among Selected Navy Enlisted Personnel," NAVAEROSPMEDRSHLAB Report NAMRL-1251, September 1978.

4. CO NAVENVIRHLTHCEN ltr 6260.5 Ser 30/04402 of 25 Apr 90

5. CO NAVENVIRHLTHCEN ltr 6260 Ser 30np/06013 1 Jun 90

6. Royster, L.H., and Royster, J.D., "Representative Hearing Levels by Race and Sex in North Carolina Industry," JASA Vol. 68 No. 2 1980.

7. CO NAVENVIRHLTHCEN ltr 6260.5 Ser 30/07059 of 5 Jul 90

8. Kryter, K.D. The Effects of Noise on Man, Academic Press, 1970.

9. Berger, E.H., Ward, W.D., Morrill, J.C., Royster, L.H., Noise & Hearing Conservation Manual, American Industrial Hygiene Association, 1986.

10. Department of Defense Directive 6130.3, Section 5, "Ears and Hearing," March 1986.

APPENDIX A

Hearing Loss "At Risk" Data Sheet

HEARING LOSS "AT RISK" DATA SHEET

SSN: ___ - __ - ____ DOB (yy-mm-dd): __ - __ - __ RATE: _____

LENGTH OF SERVICE (From Activity Search Sheet): ___ Years, ___ Months

SOURCE OF OLDEST AUDIOGRAM: SF-88 DD2215 DD2216 OTHER (Specify)

DATE OF OLDEST AUDIOGRAM: (yy-mm-dd) __ - __ - __

RIGHT						LEFT					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
___	____	____	____	____	____	___	____	____	____	____	____

SOURCE OF MOST RECENT AUDIOGRAM: SF-88 DD2215 DD2216 OTHER (Specify)

DATE OF MOST RECENT AUDIOGRAM: (yy-mm-dd) __ - __ - __

RIGHT						LEFT					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
___	____	____	____	____	____	___	____	____	____	____	____

HAS NEW REFERENCE AUDIOGRAM BEEN ESTABLISHED? Yes No

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

SSN: ___ - __ - ____ DOB (yy-mm-dd): __ - __ - __ RATE: _____

LENGTH OF SERVICE (From Activity Search Sheet): ___ Years, ___ Months

SOURCE OF OLDEST AUDIOGRAM: SF-88 DD2215 DD2216 OTHER (Specify)

DATE OF OLDEST AUDIOGRAM: (yy-mm-dd) __ - __ - __

RIGHT						LEFT					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
___	____	____	____	____	____	___	____	____	____	____	____

SOURCE OF MOST RECENT AUDIOGRAM: SF-88 DD2215 DD2216 OTHER (Specify)

DATE OF MOST RECENT AUDIOGRAM: (yy-mm-dd) __ - __ - __

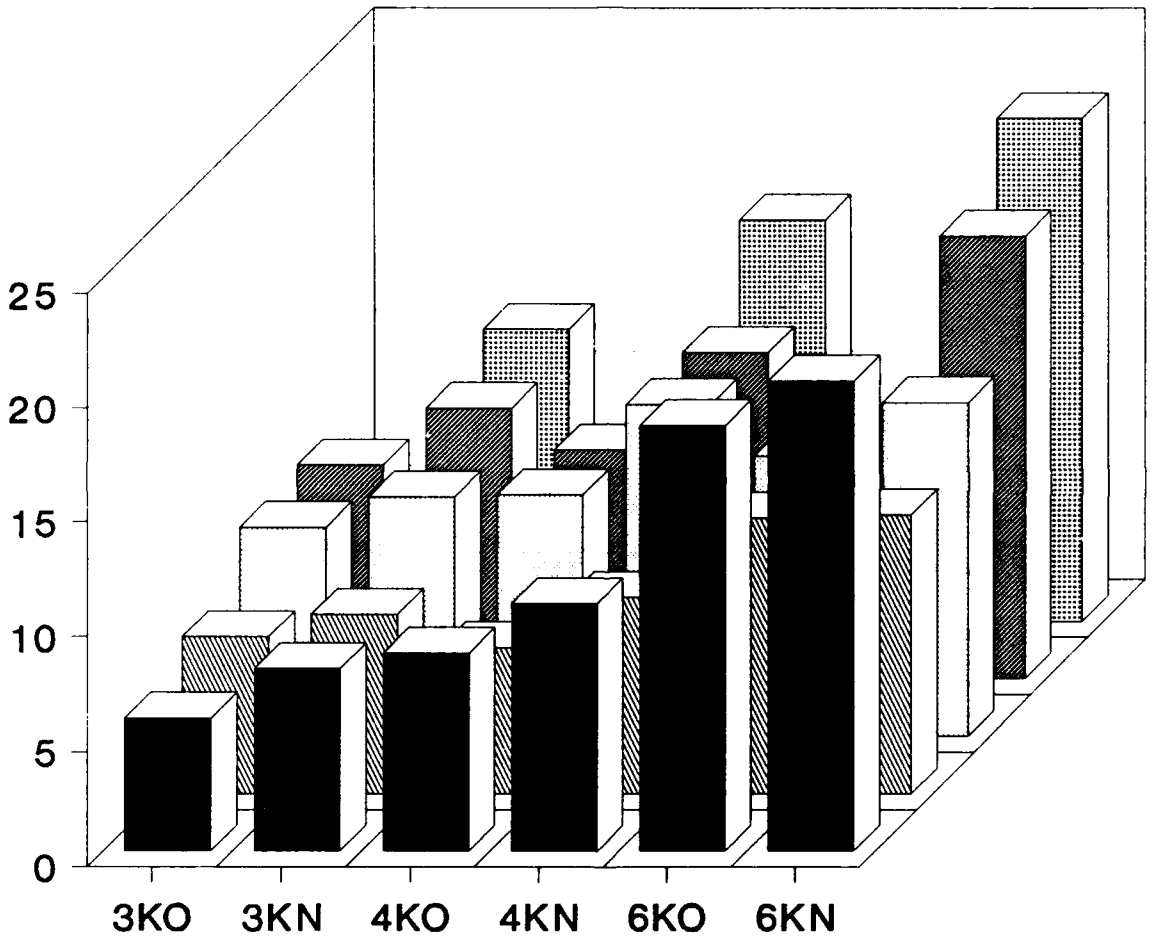
RIGHT						LEFT					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
___	____	____	____	____	____	___	____	____	____	____	____

HAS NEW REFERENCE AUDIOGRAM BEEN ESTABLISHED? Yes No

APPENDIX B

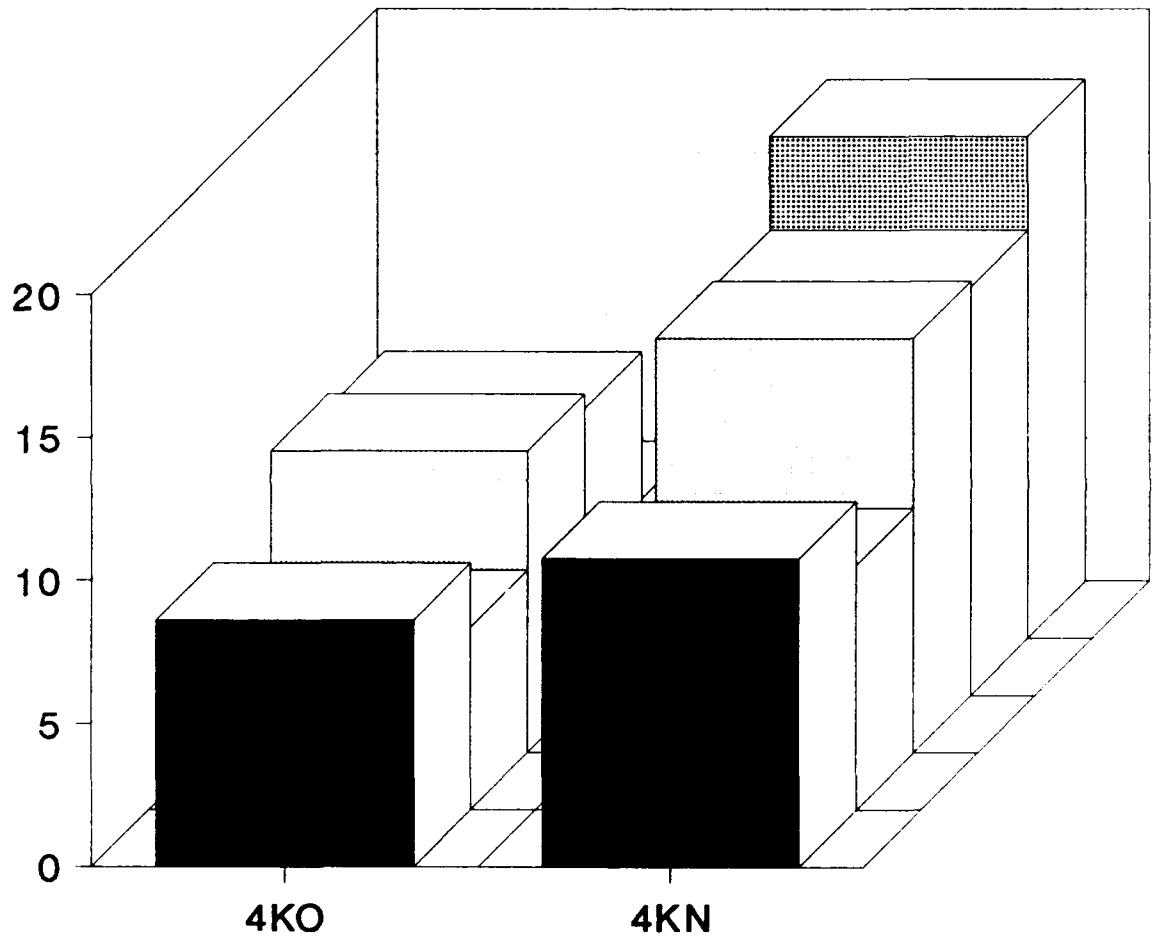
A Depiction of Hearing Thresholds in Each Length of Service Category for Ratings Evaluated

AT-RISK EVALUATION
RATE = ABE



High Frequency Analysis

AT-RISK EVALUATION
RATE = ABE

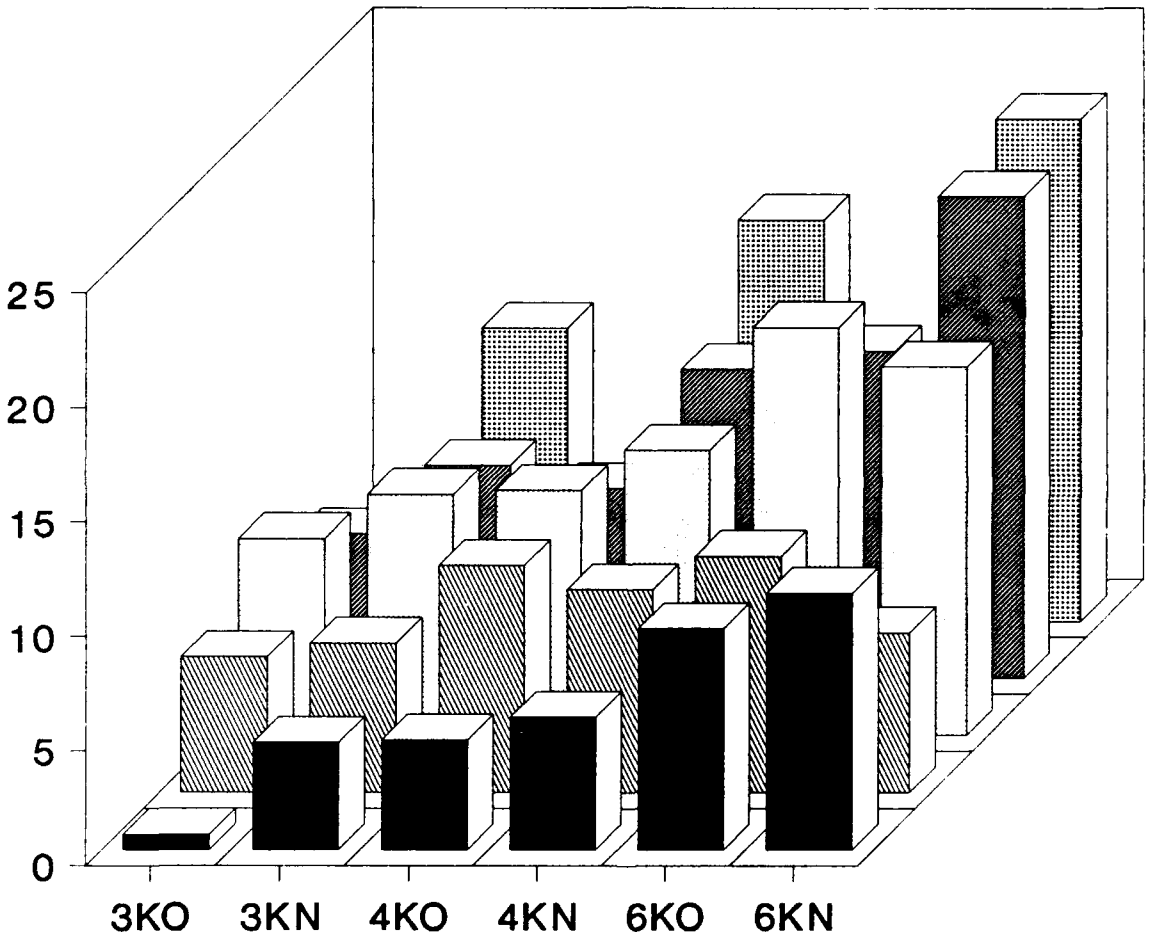


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all ABs)

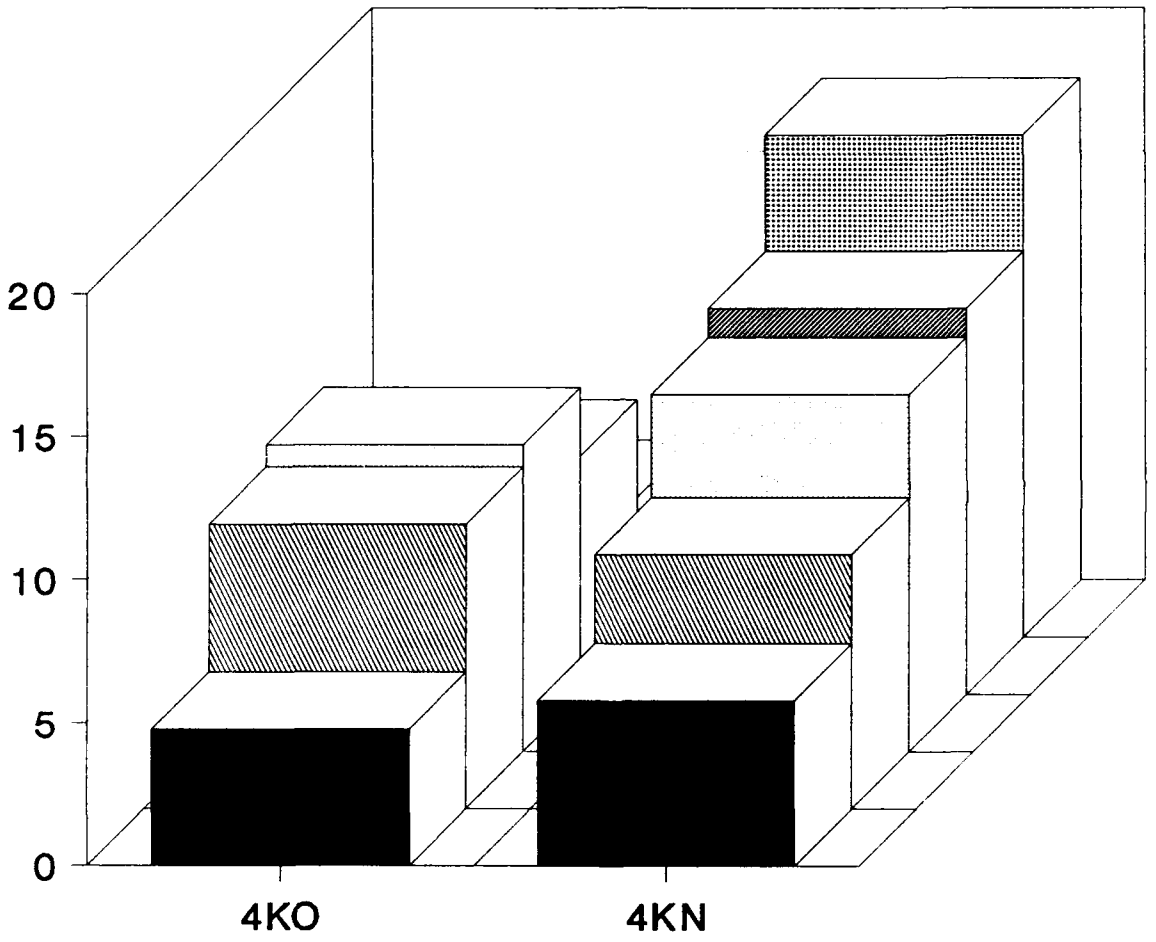
High Frequency Analysis

AT-RISK EVALUATION
RATE = ABF



High Frequency Analysis

AT-RISK EVALUATION
RATE = ABF



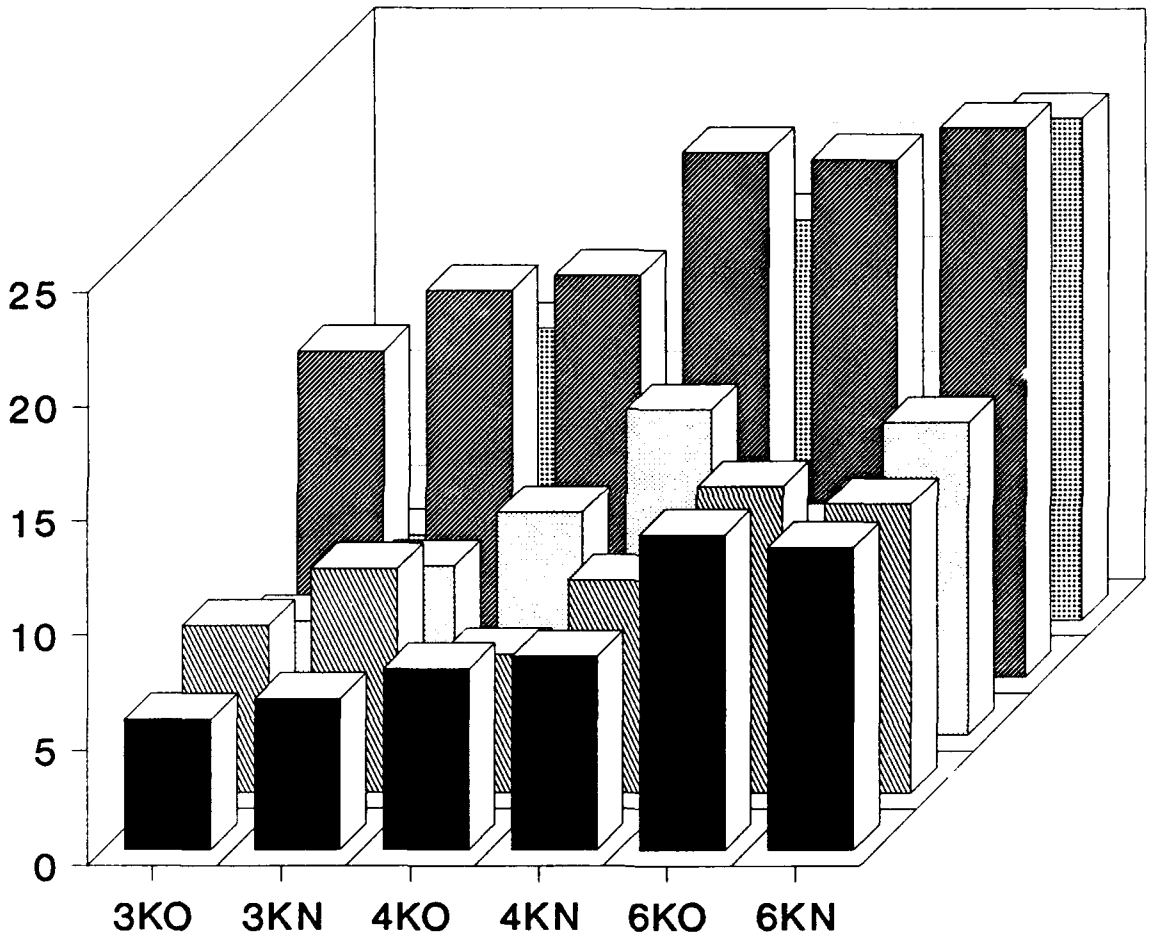
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-20yrs
LOS 20+yrs (all ABs)

High Frequency Analysis

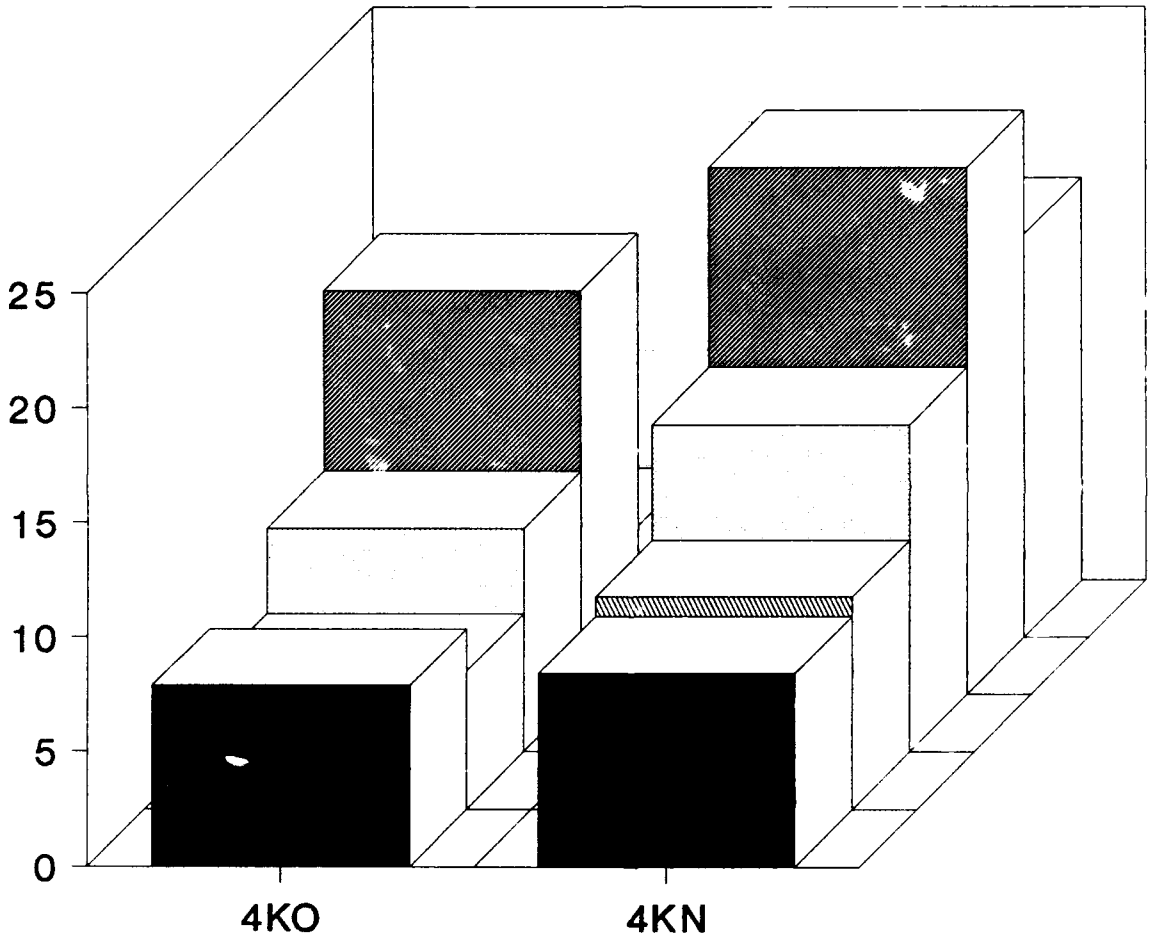
AT-RISK EVALUATION

RATE = ABH



High Frequency Analysis

AT-RISK EVALUATION
RATE = ABH



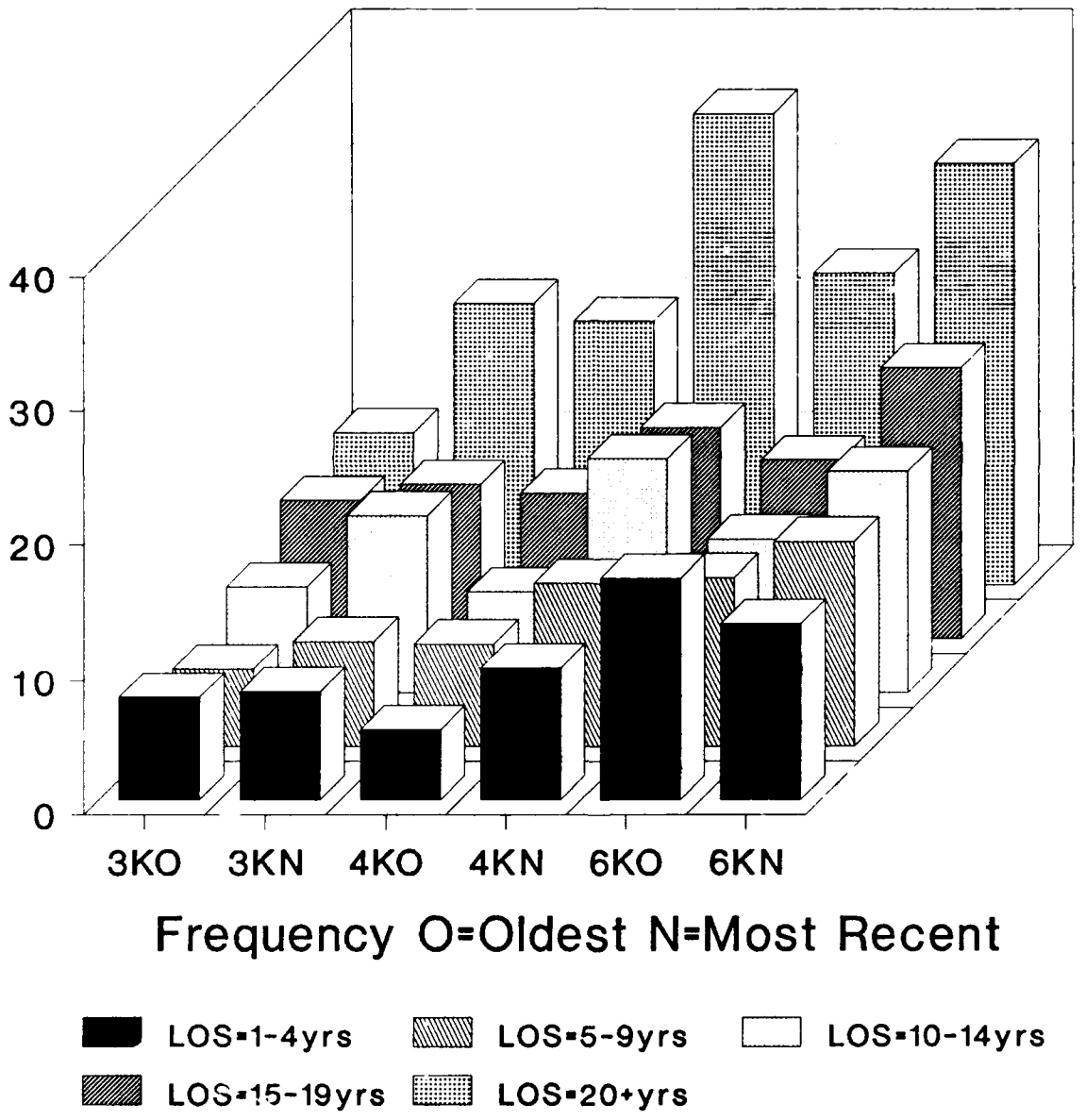
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-20yrs
LOS 20+yrs (all ABs)

High Frequency Analysis

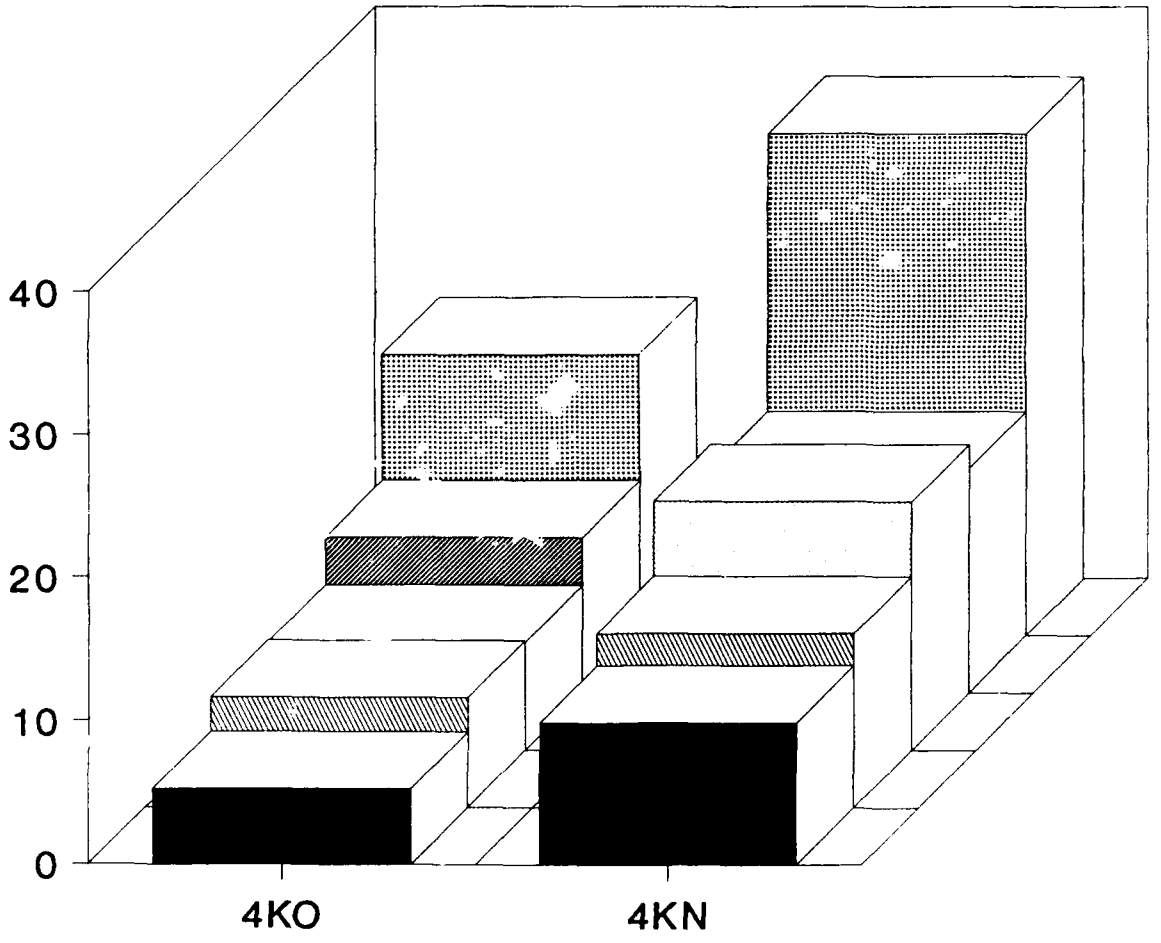
AT-RISK EVALUATION

RATE = AD



High Frequency Analysis

AT-RISK EVALUATION
RATE = AD

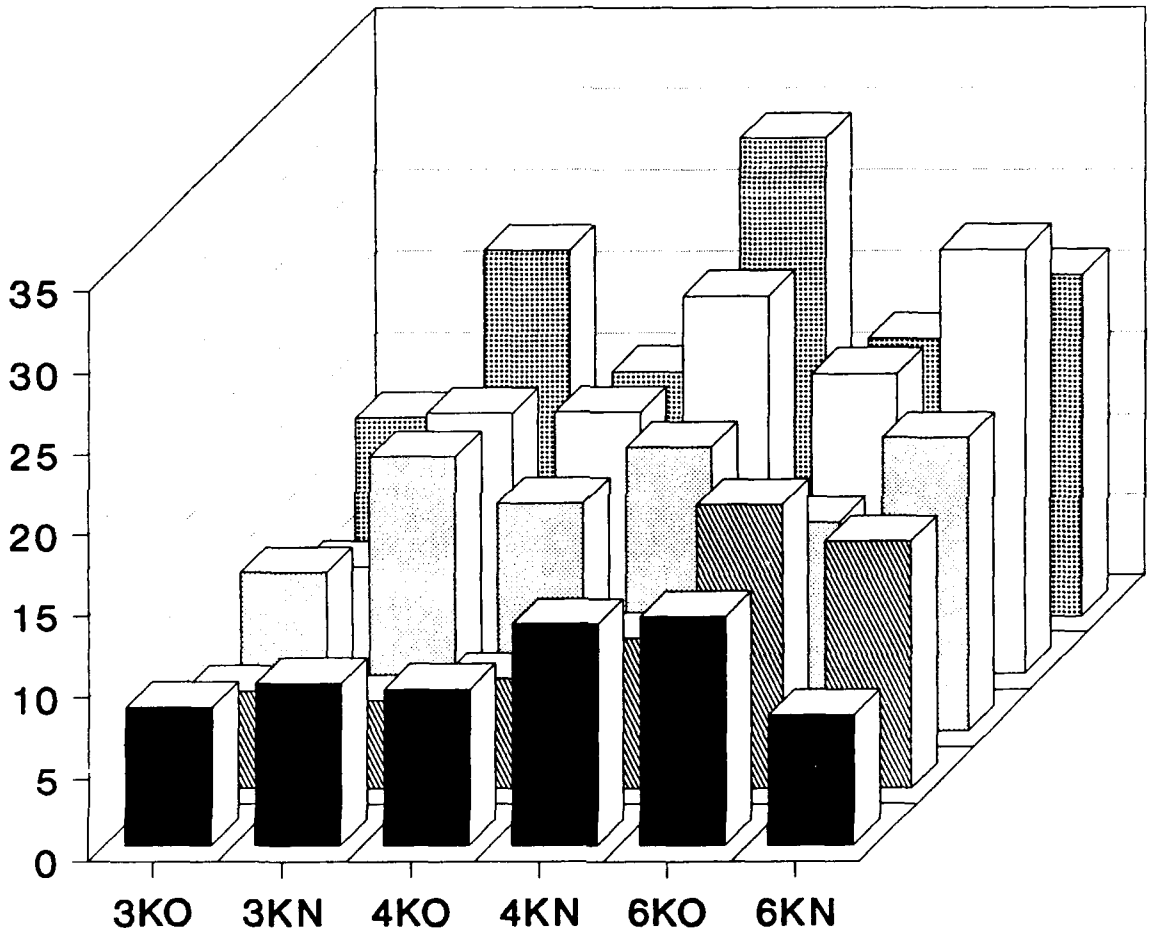


Frequency O=Oldest N=Most Recent

LOS=1-4yrs
LOS=5-9yrs
LOS=10-14yrs
LOS=15-19yrs
LOS=20+yrs

High Frequency Analysis

AT-RISK EVALUATION
RATE = AME

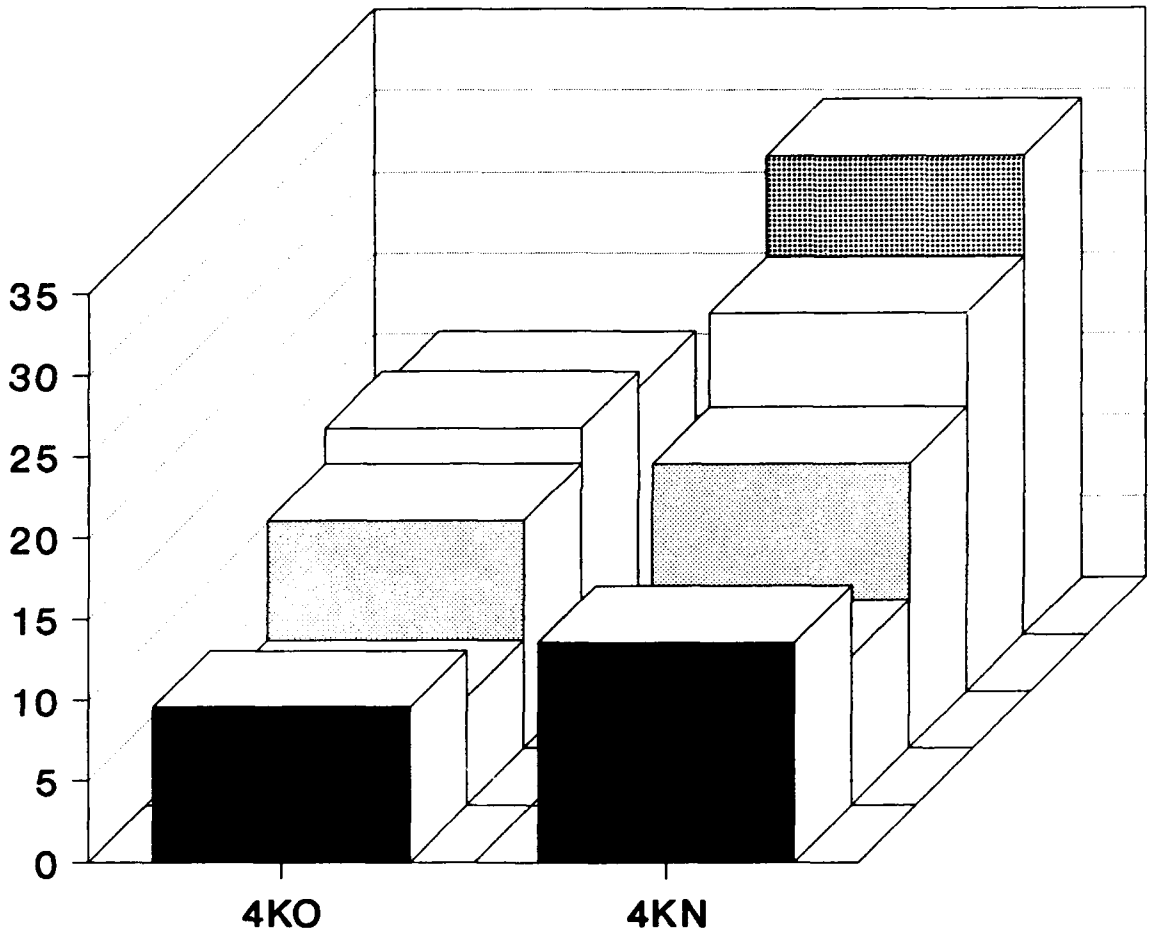


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all AMs)

High Frequency Analysis

AT-RISK EVALUATION
RATE = AME



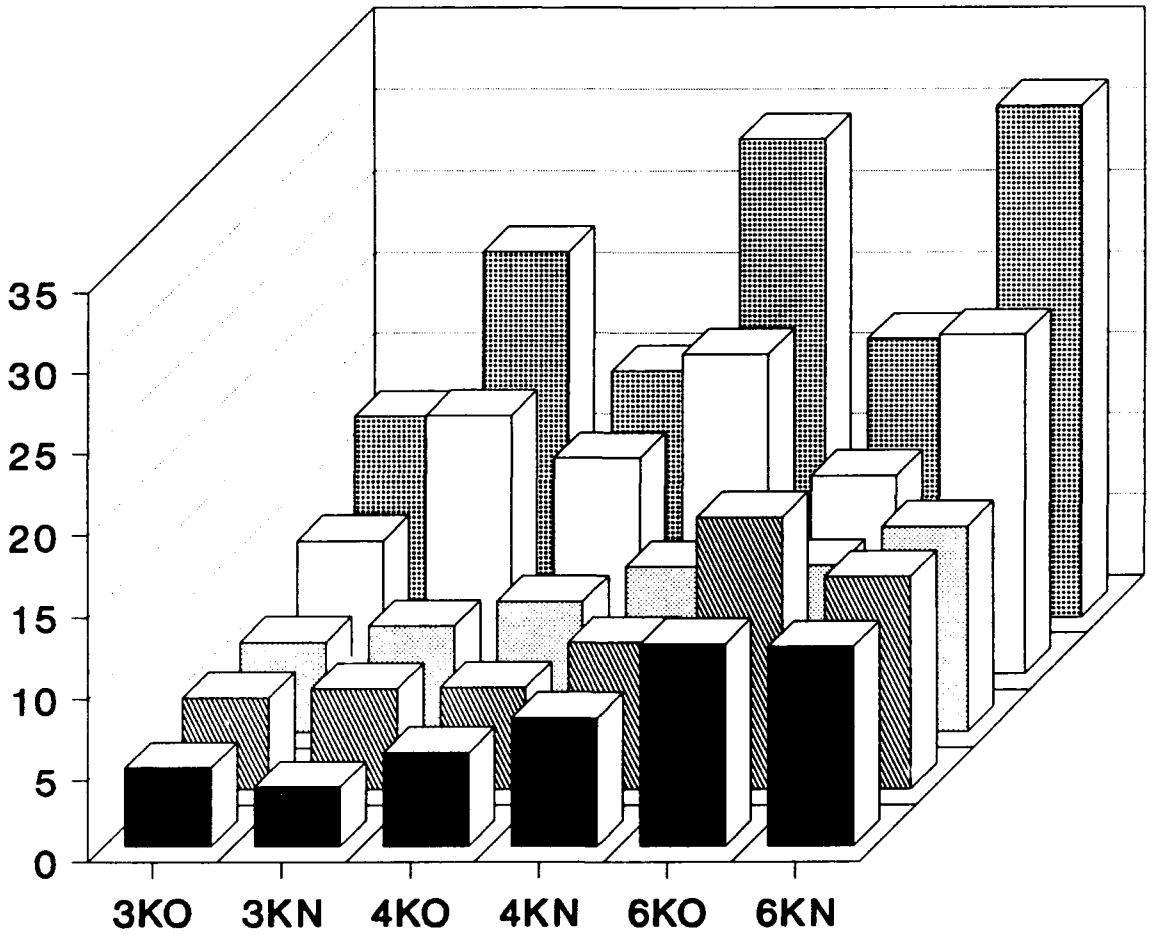
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all AMs)

High Frequency Analysis

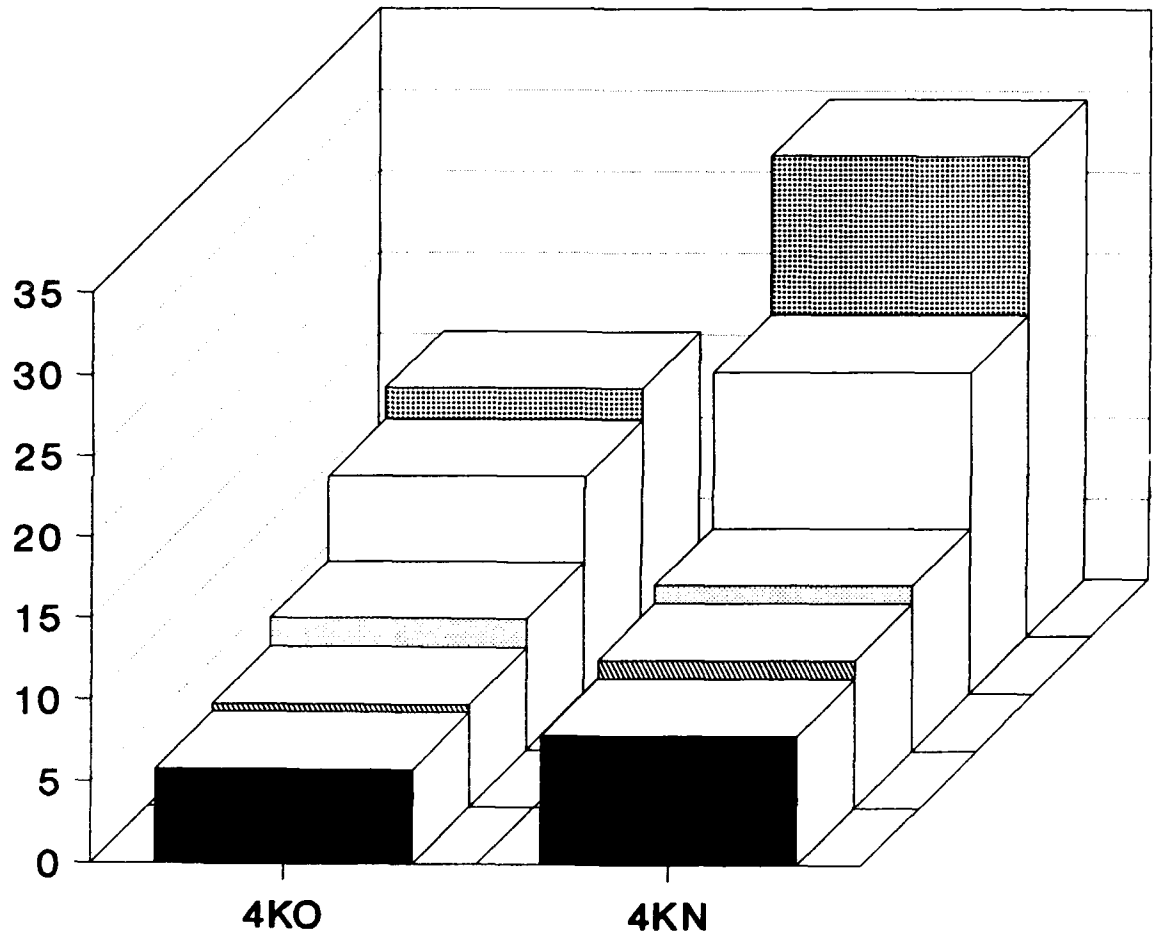
AT-RISK EVALUATION

RATE = AMH



High Frequency Analysis

AT-RISK EVALUATION
RATE = AMH



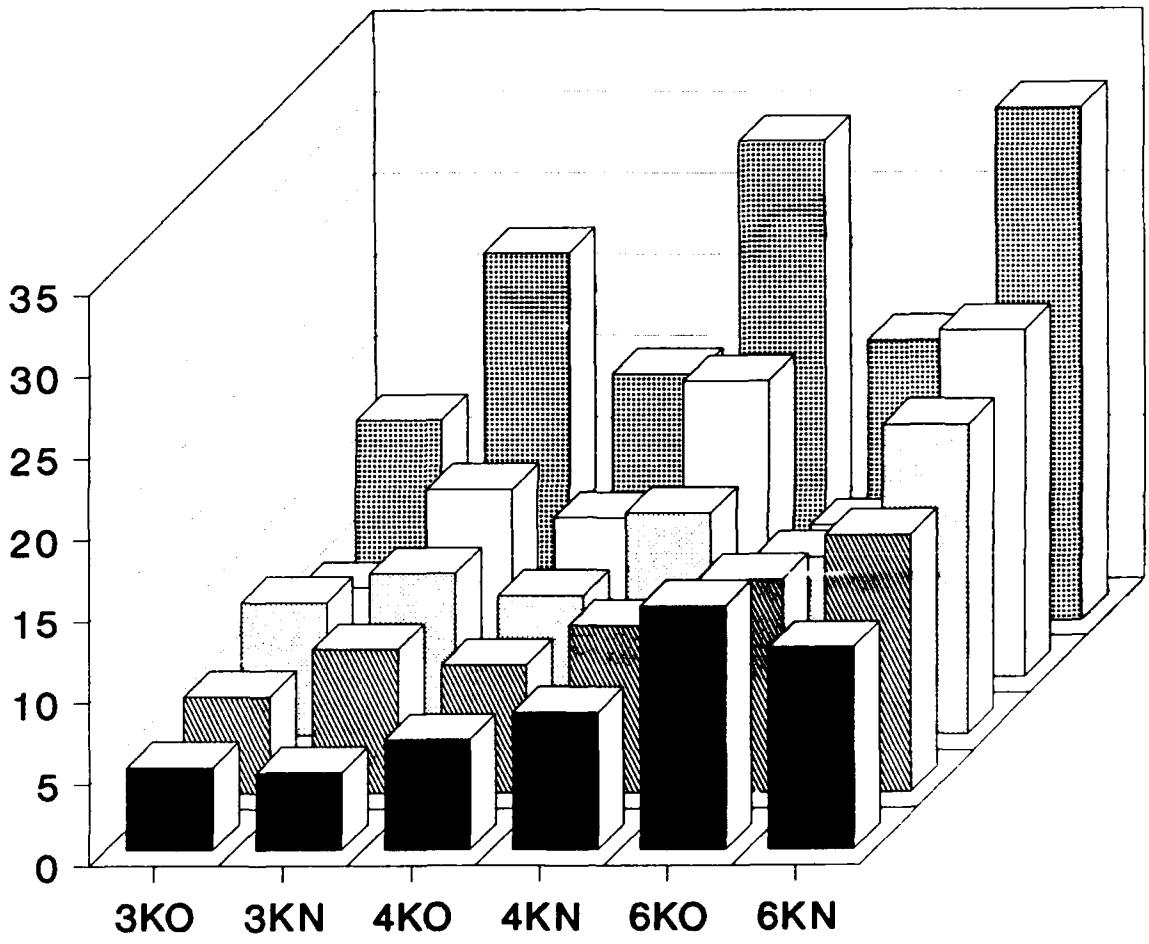
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all AMs)

High Frequency Analysis

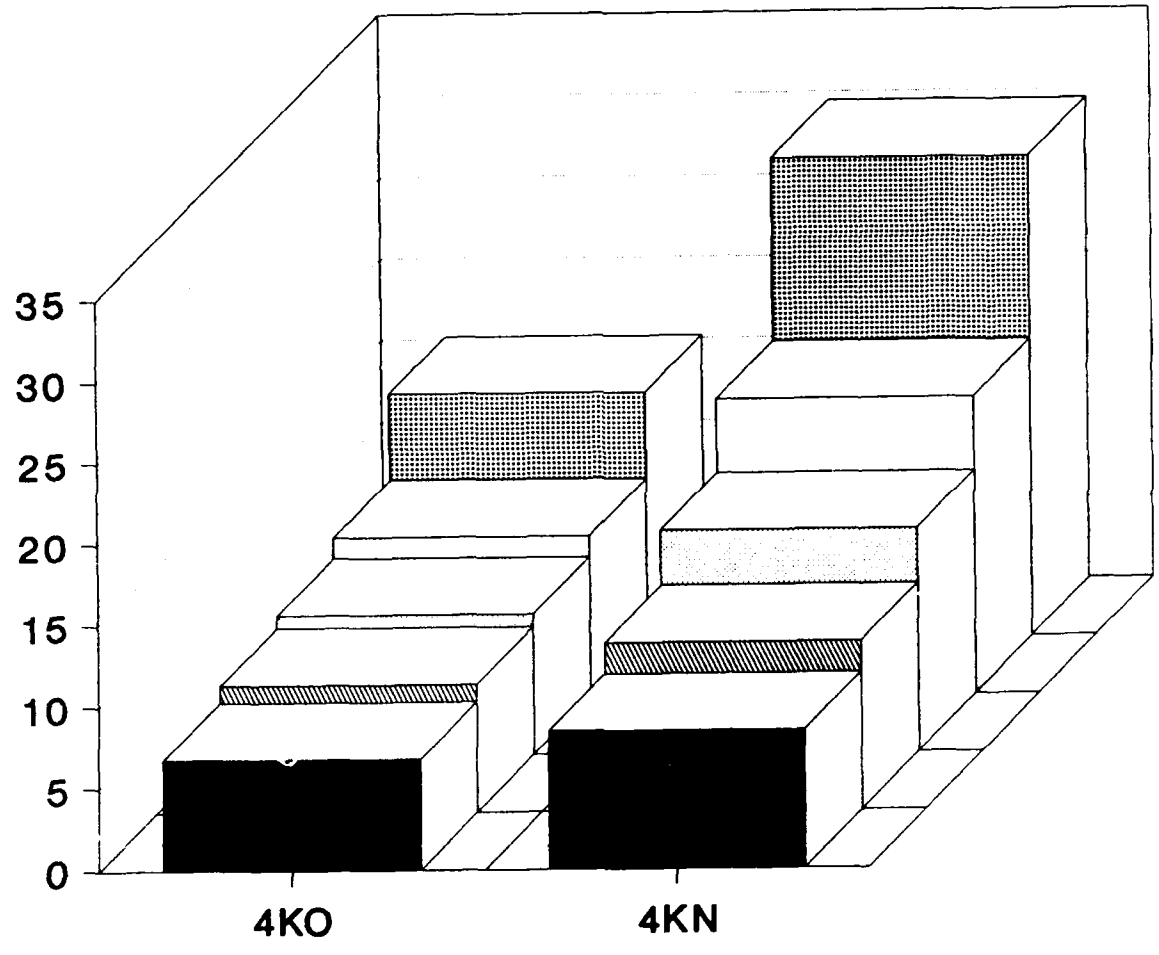
AT-RISK EVALUATION

RATE = AMS



High Frequency Analysis

AT-RISK EVALUATION
RATE = AMS

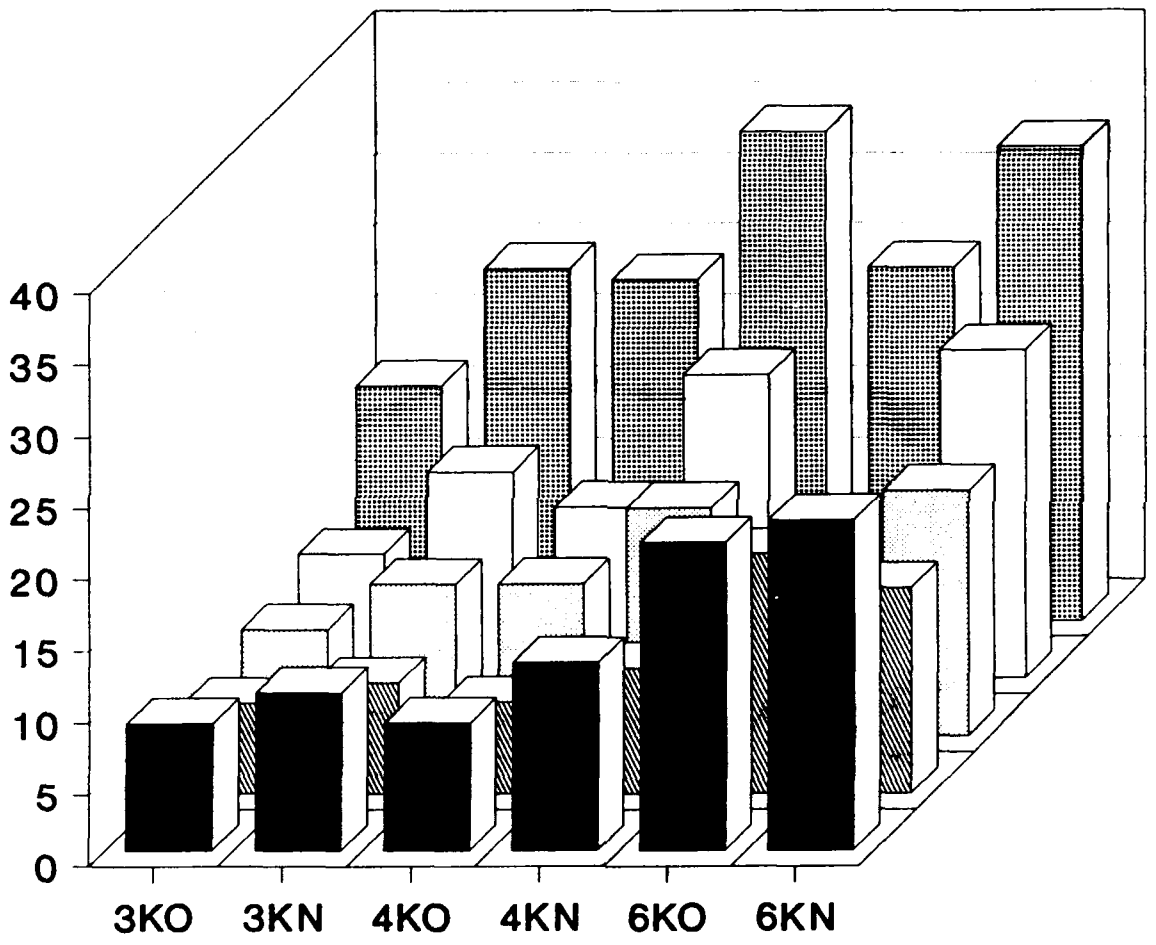


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all AMs)

High Frequency Analysis

AT-RISK EVALUATION
RATE = AO



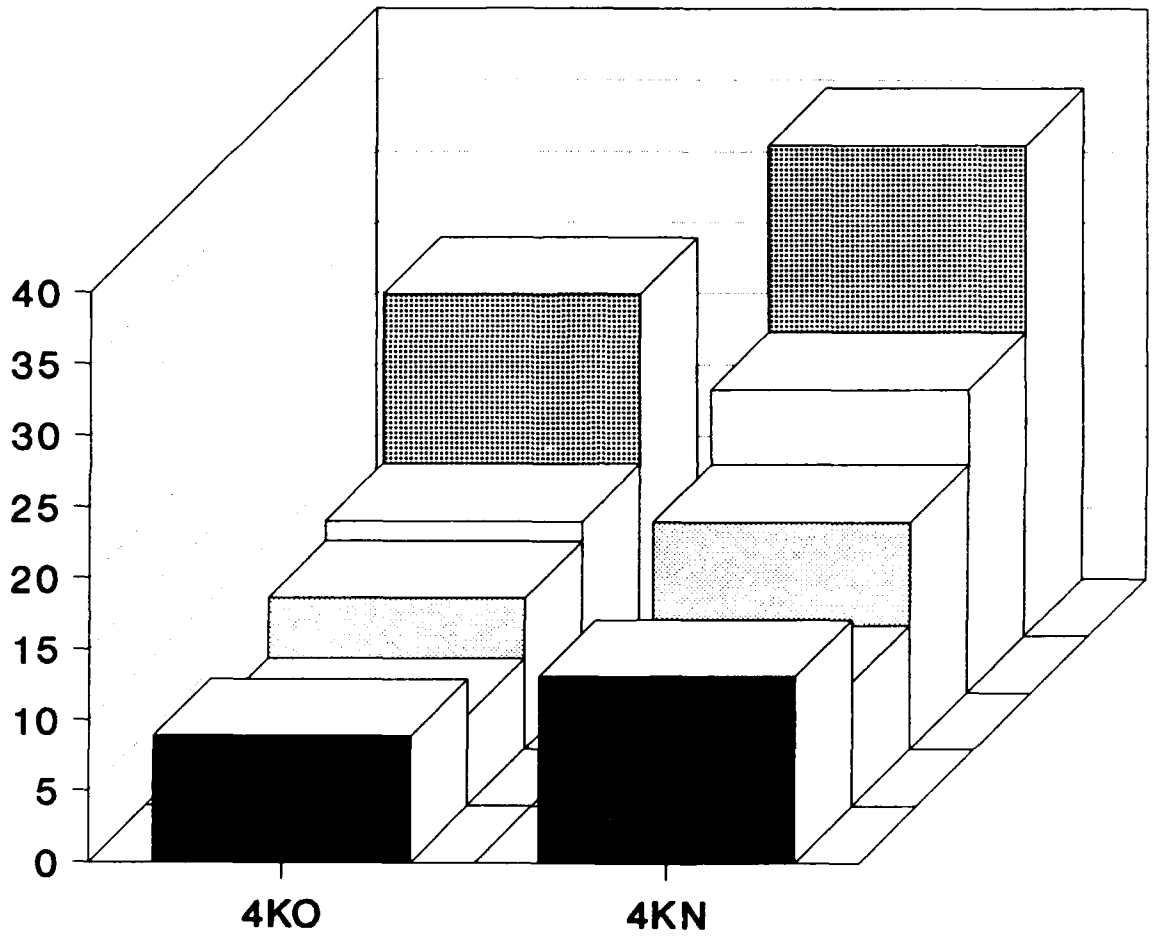
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

RATE = AO



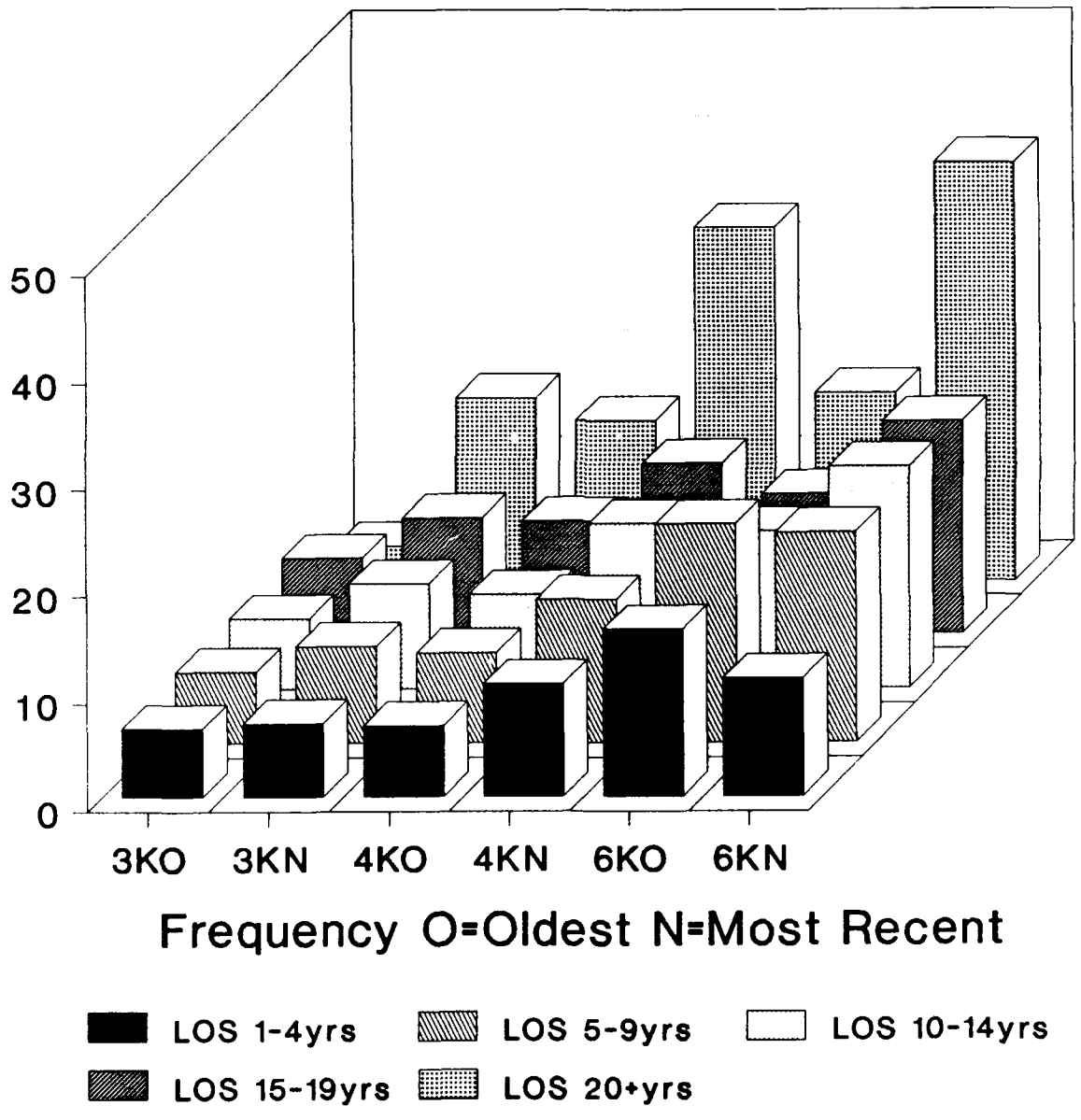
Frequency O=Oldest N=Most Recent

LOS=1-4yrs
LOS=5-9yrs
LOS=10-14yrs
LOS=15-19yrs
LOS=20+yrs

High Frequency Analysis

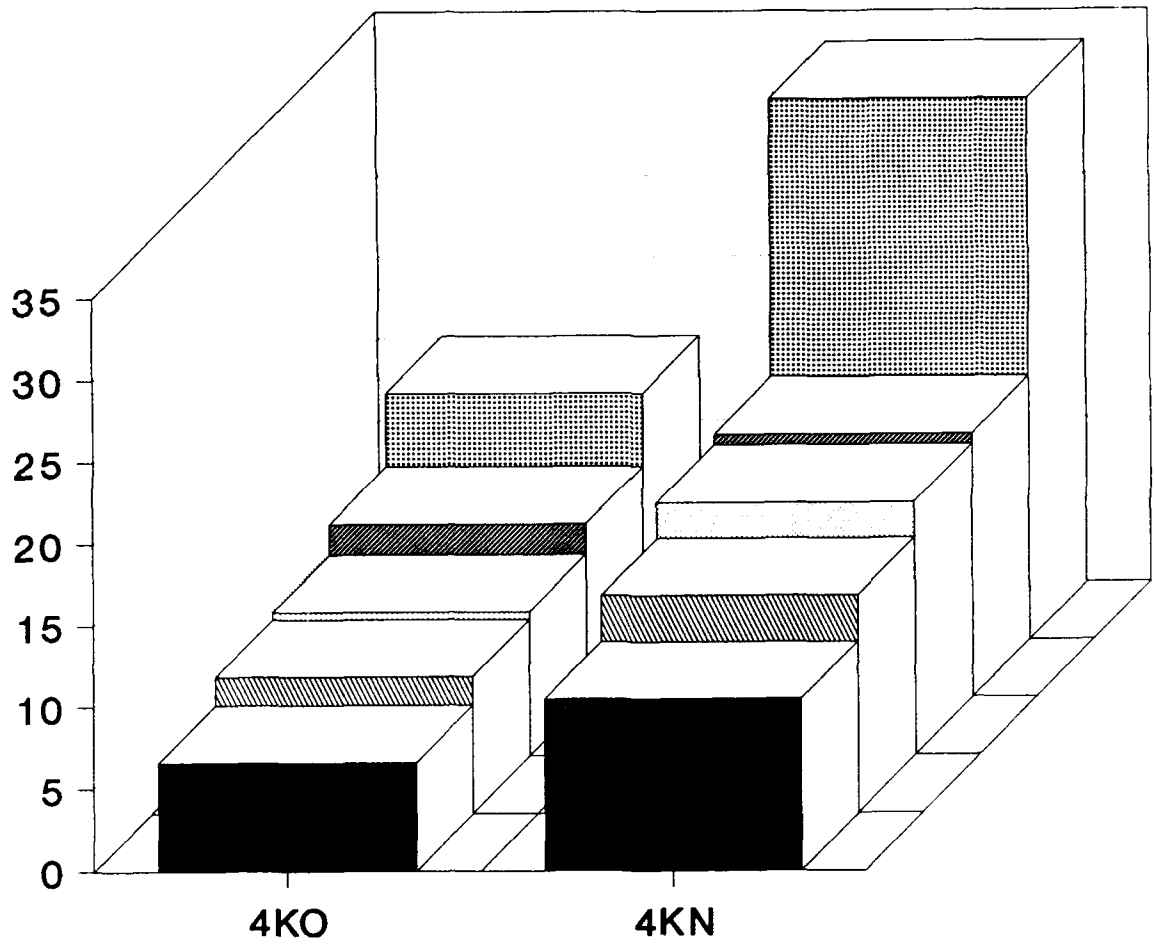
AT-RISK EVALUATION

RATE = AW



High Frequency Analysis

AT-RISK EVALUATION
RATE = AW



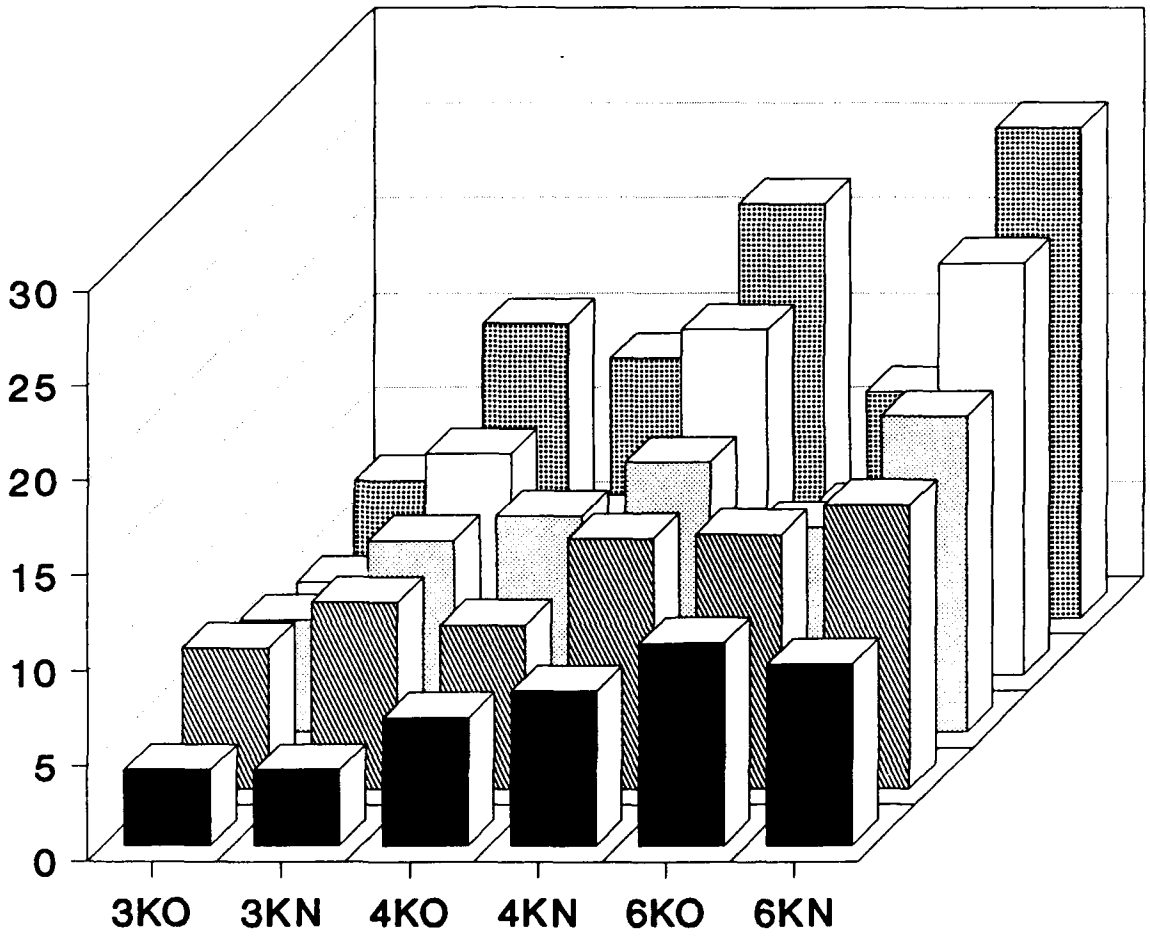
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

Rate = BM



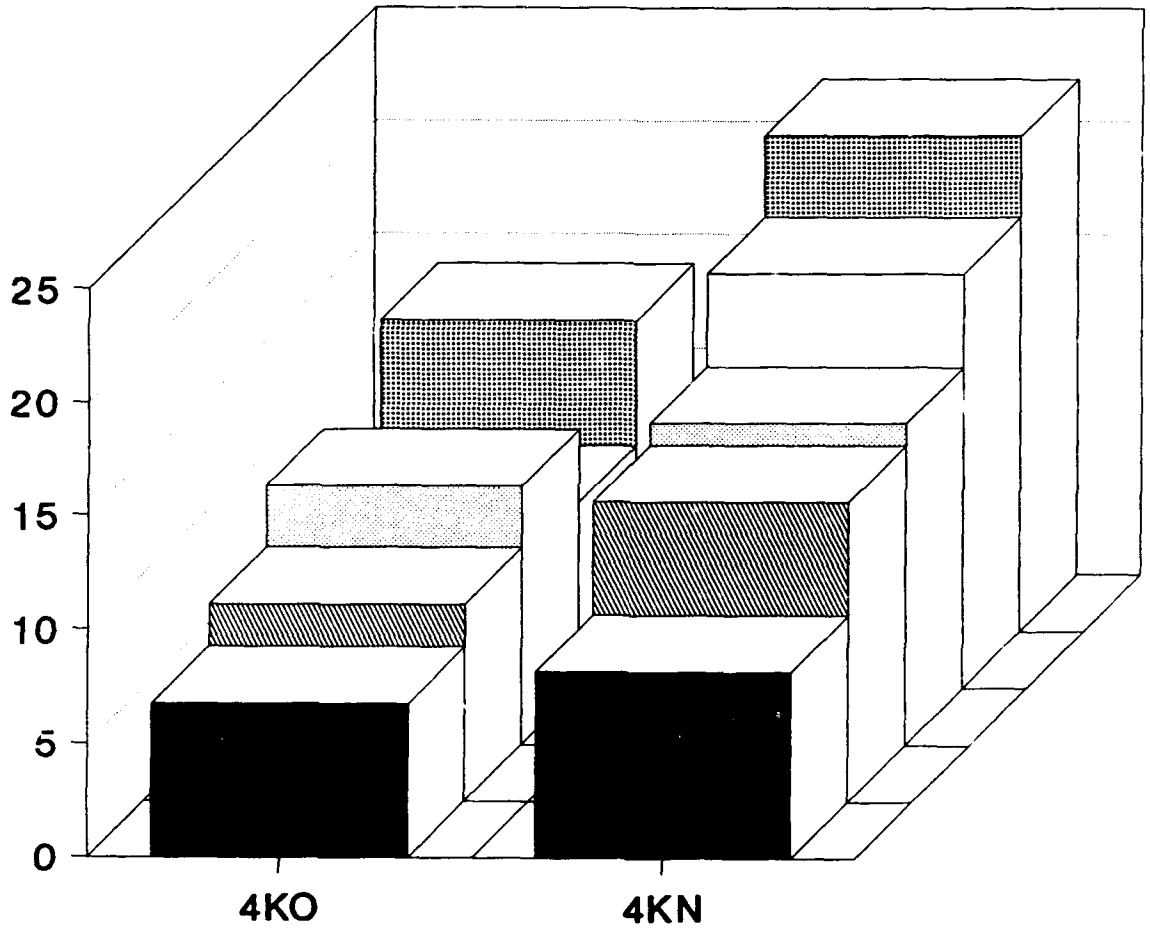
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

Rate = BM

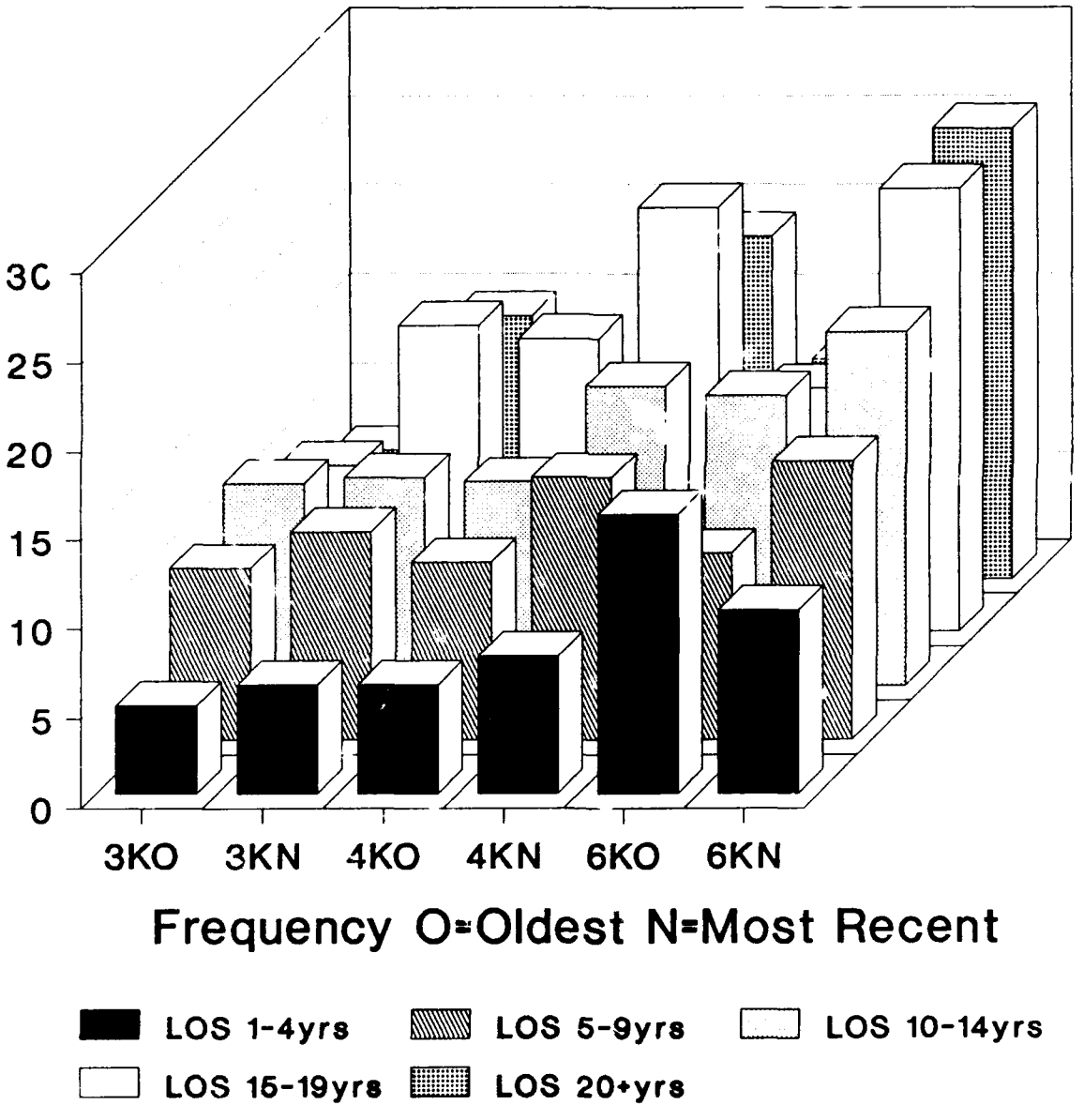


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

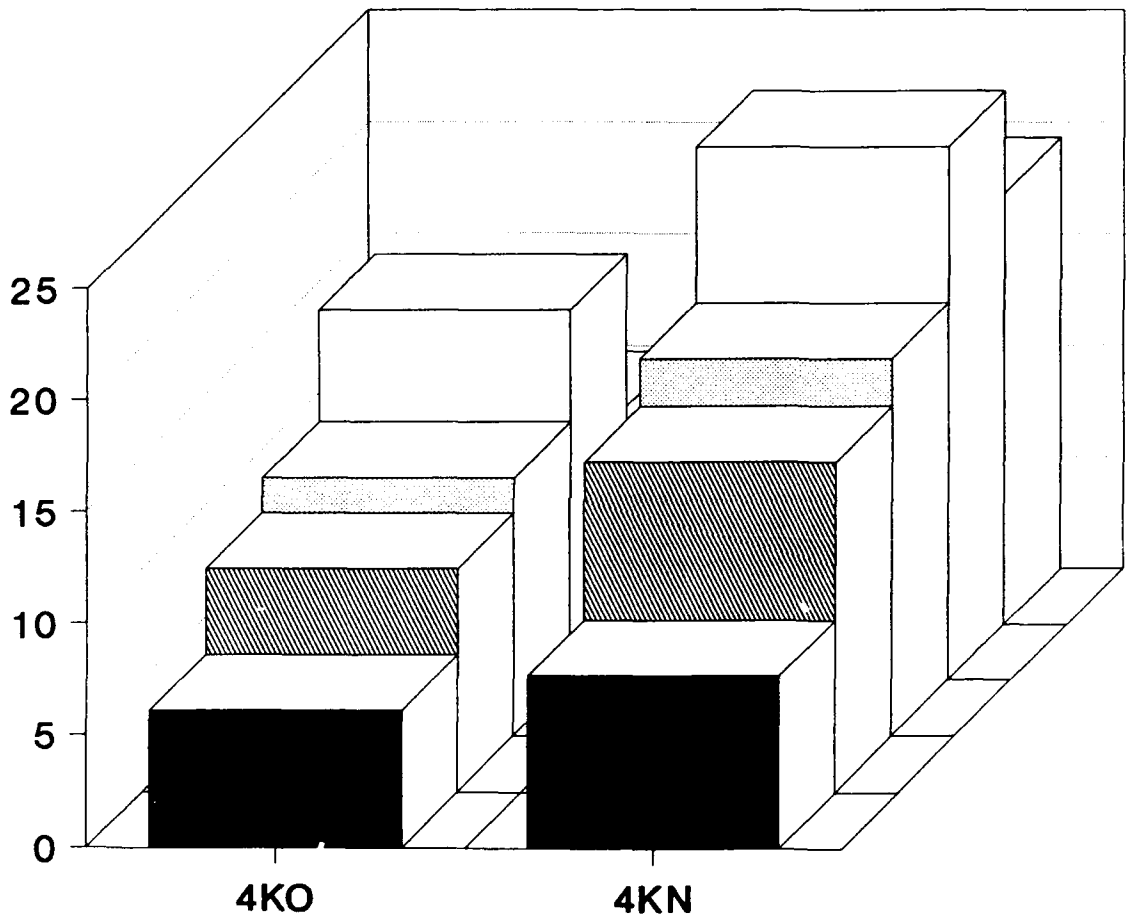
High Frequency Analysis

AT-RISK EVALUATION
RATE = BT



High Frequency Analysis

AT-RISK EVALUATION
RATE = BT



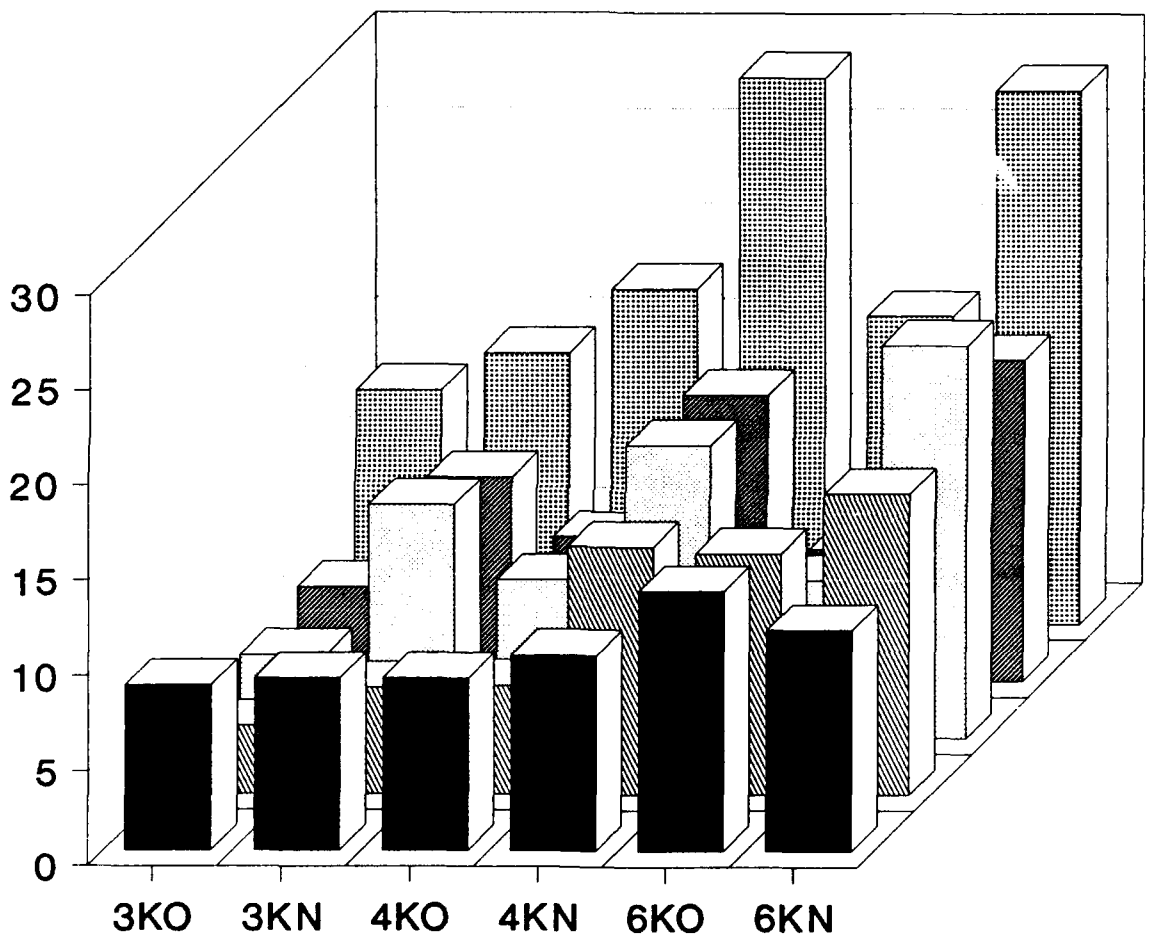
Frequency O=Oldest N=Most Recent

LOS=1-4yrs
LOS=5-9yrs
LOS=10-14yrs
LOS=15-19yrs
LOS=20+yrs

High Frequency Analysis

AT-RISK EVALUATION

RATE = BU



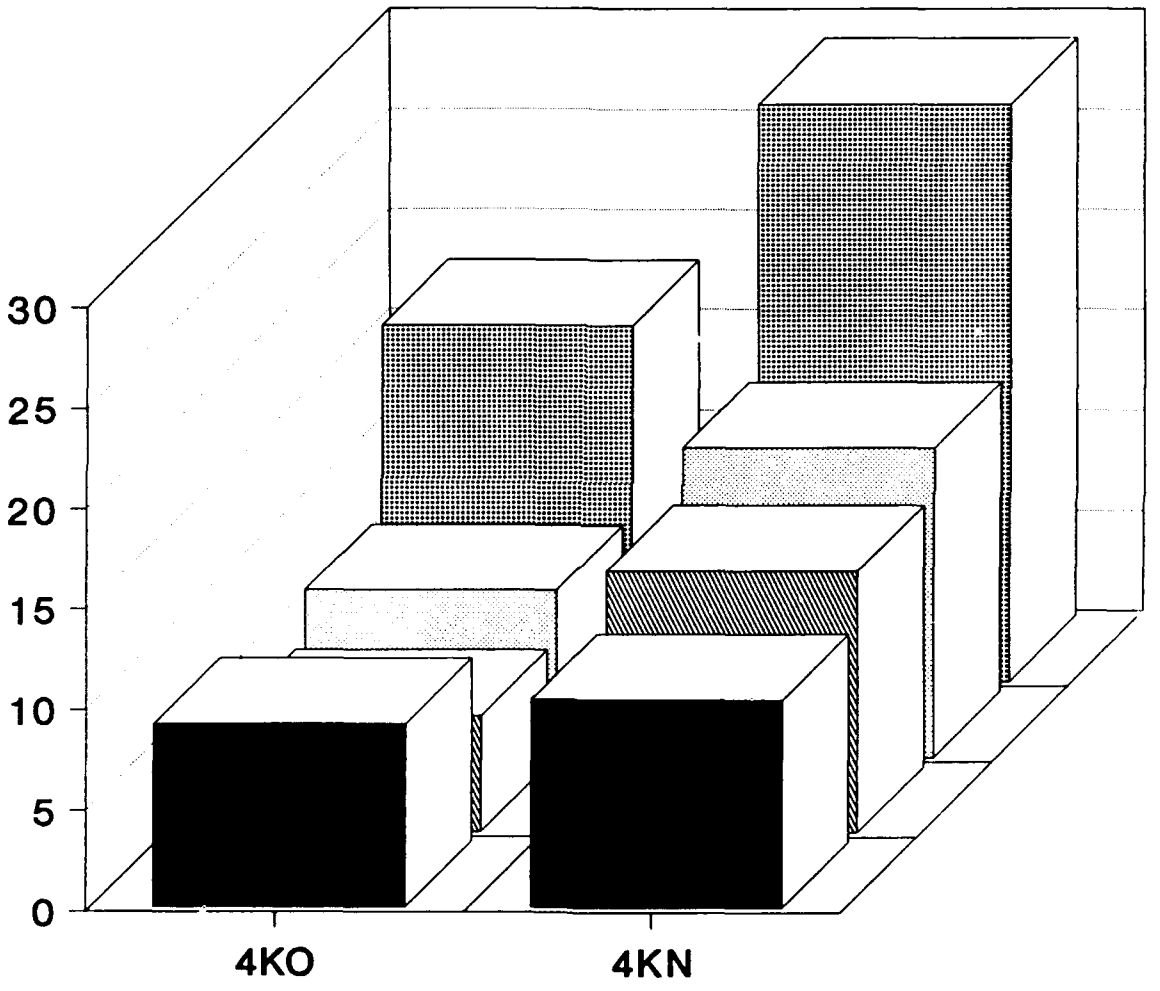
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

RATE = BU



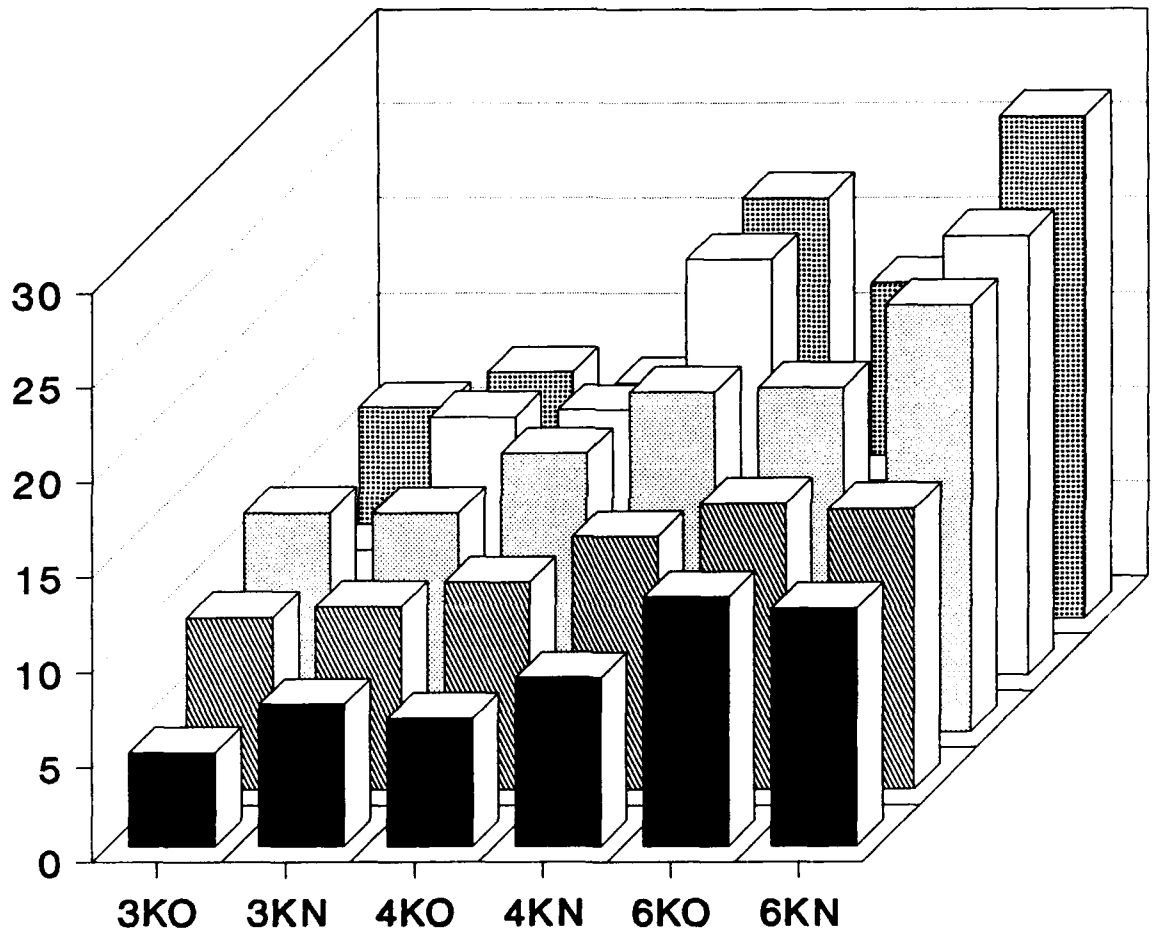
Frequency O=Oldest N=Most Recent

- LOS=1-4yrs
- LOS=5-9yrs
- LOS=10-14yrs
- LOS=20+yrs

High Frequency Analysis

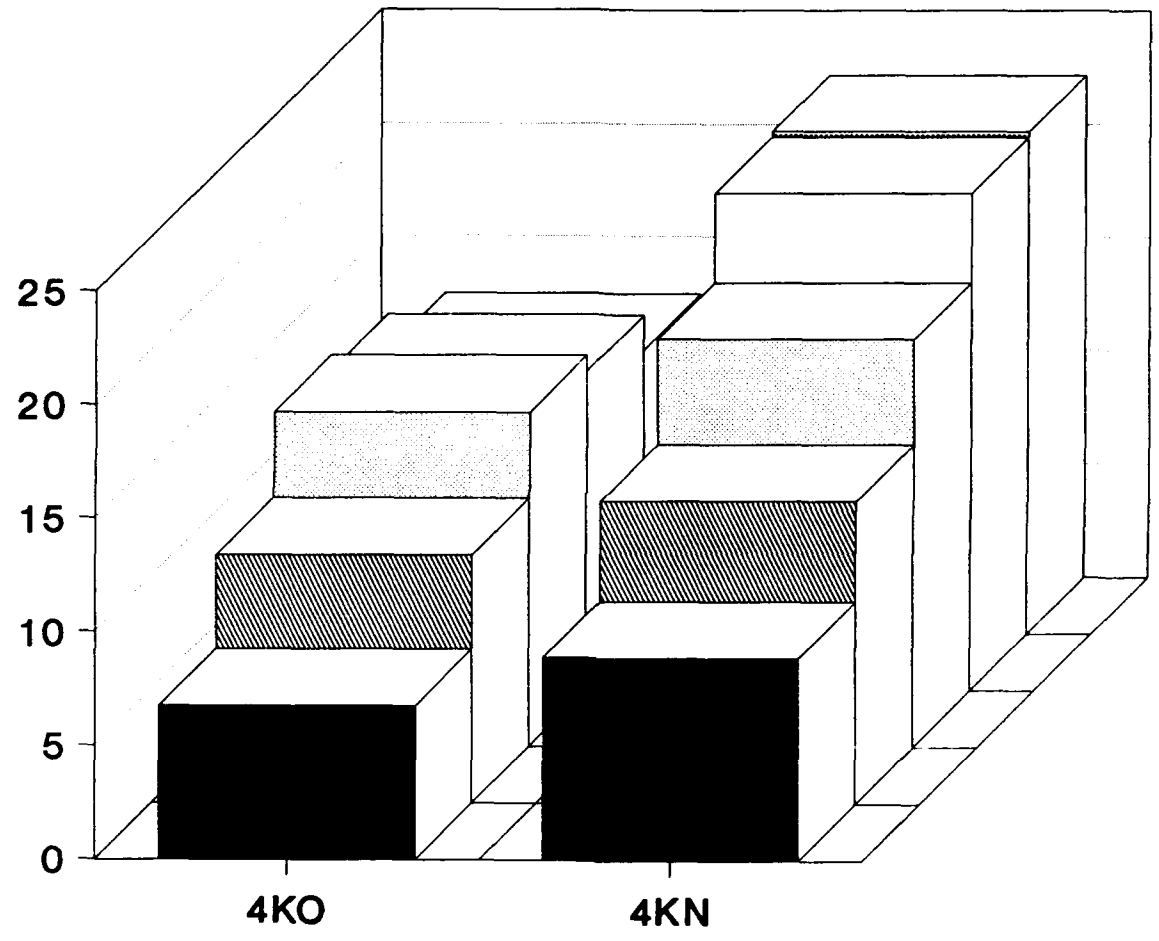
AT-RISK EVALUATION

RATE = EN



High Frequency Analysis

AT-RISK EVALUATION
RATE = EN

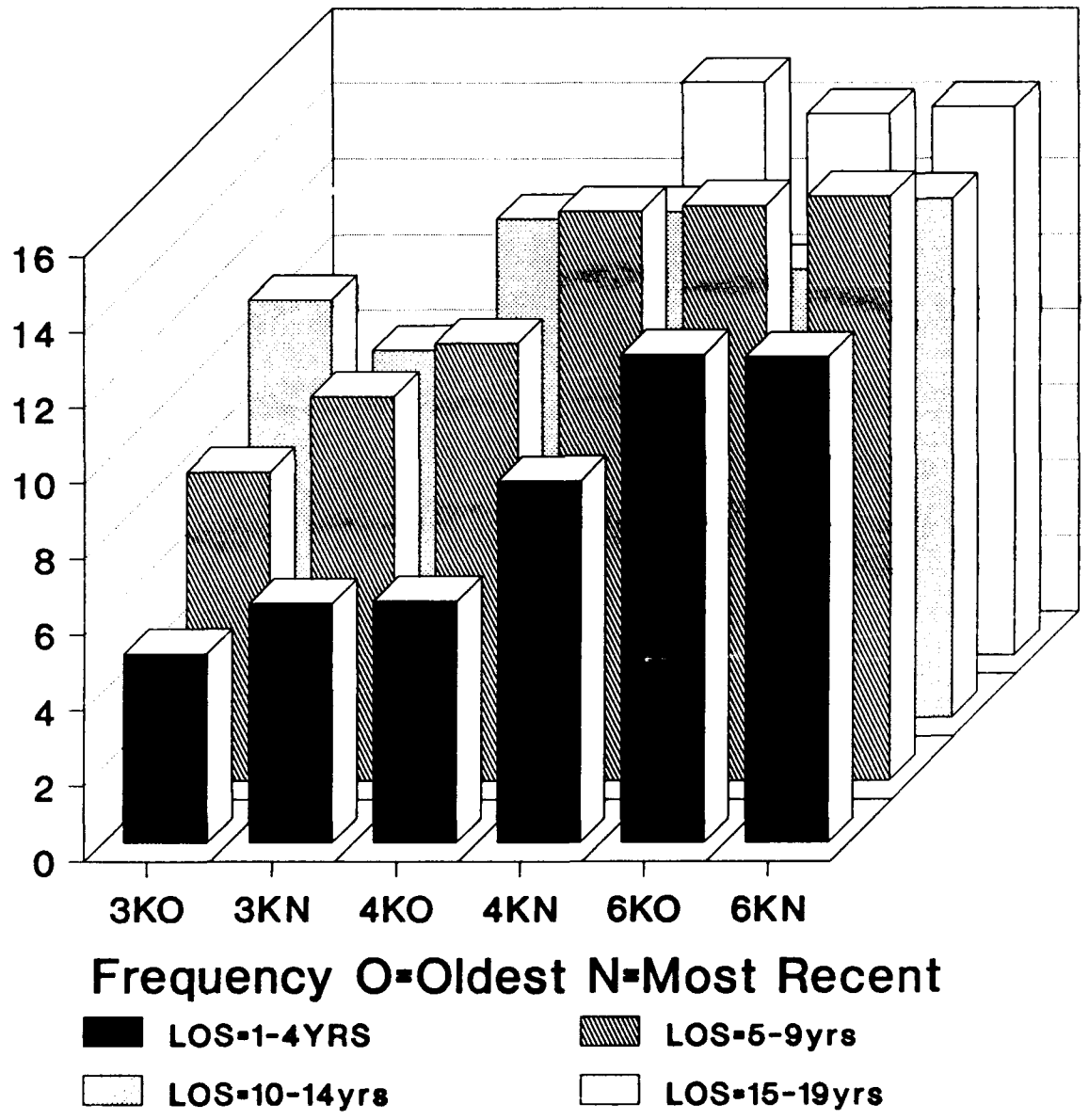


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

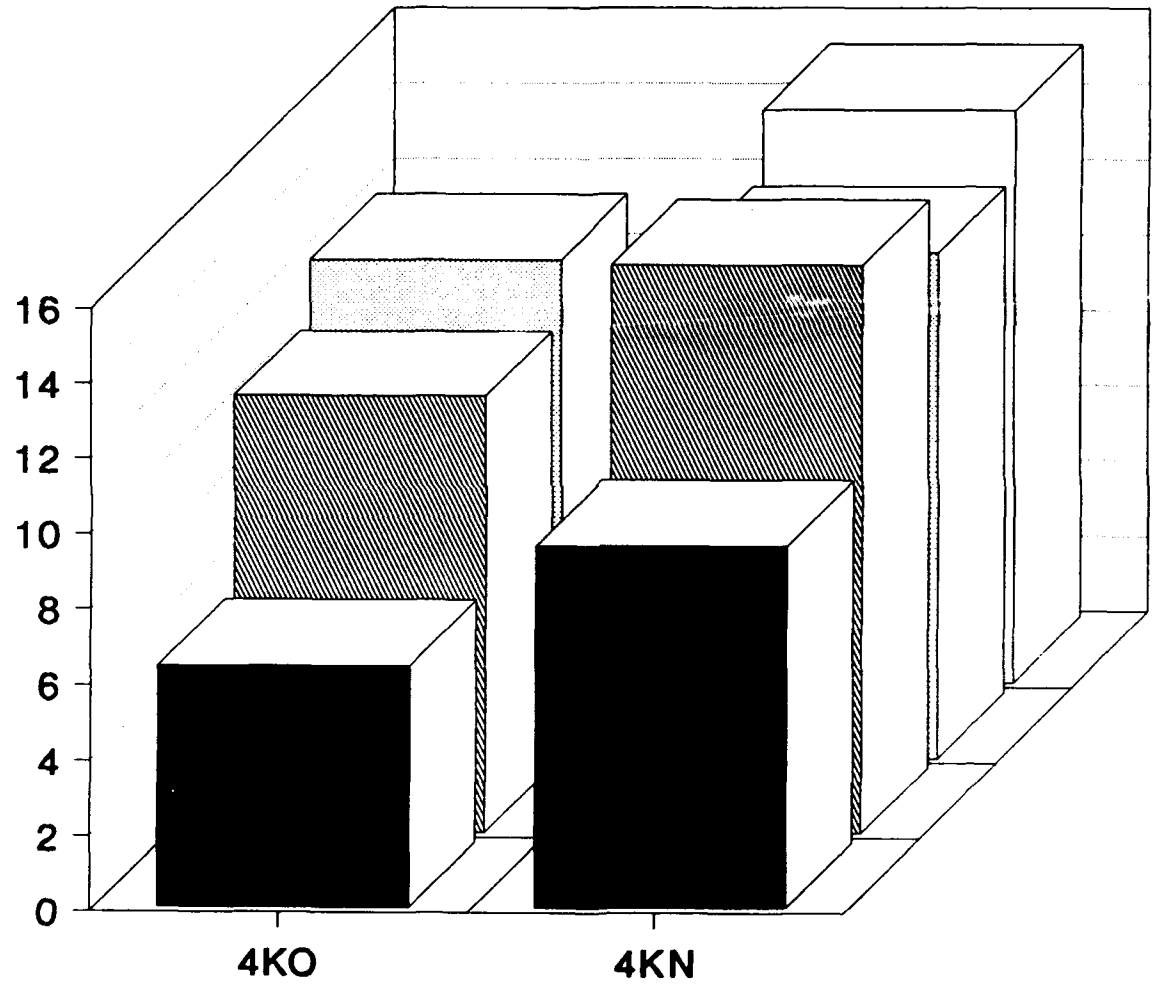
AT-RISK EVALUATION
RATE = EO



High Frequency Analysis

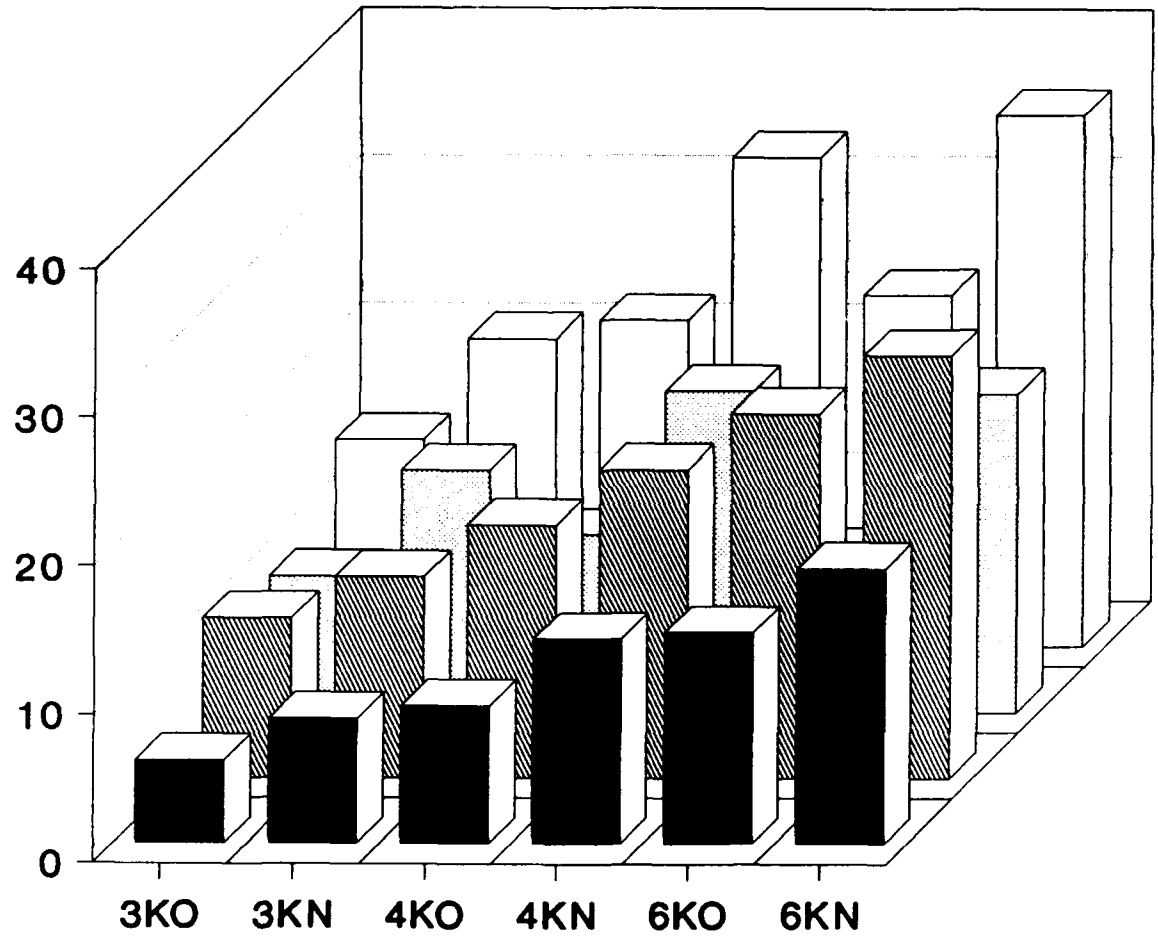
AT-RISK EVALUATION

RATE = EO



High Frequency Analysis

AT-RISK EVALUATION
RATE = GMG



Frequency O=Oldest N=Most Recent

LOS 5-9yrs

LOS 10-14yrs

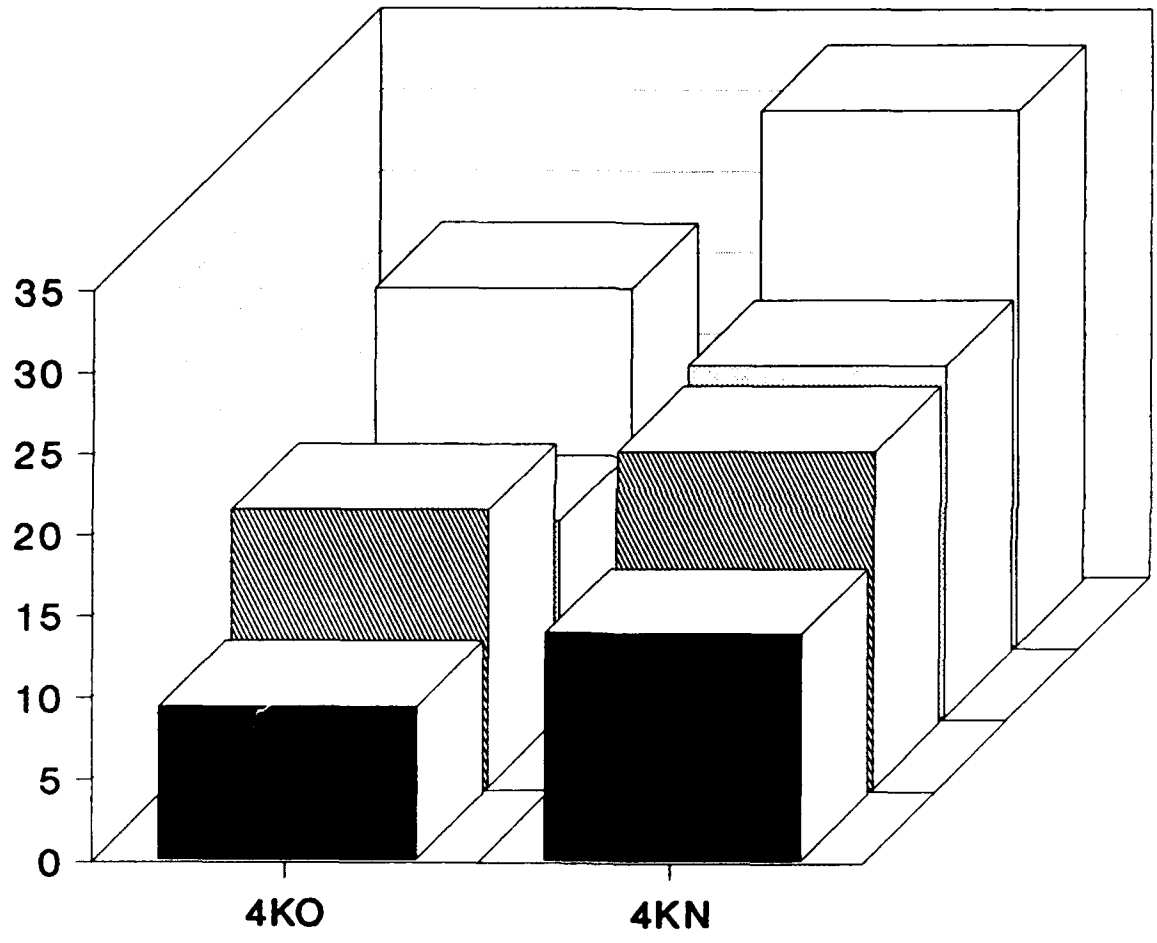
LOS 15-19yrs

LOS 20+yrs (all GMs)

Hi Freq Analysis (No LOS 1-4yrs)

AT-RISK EVALUATION

RATE = GMG



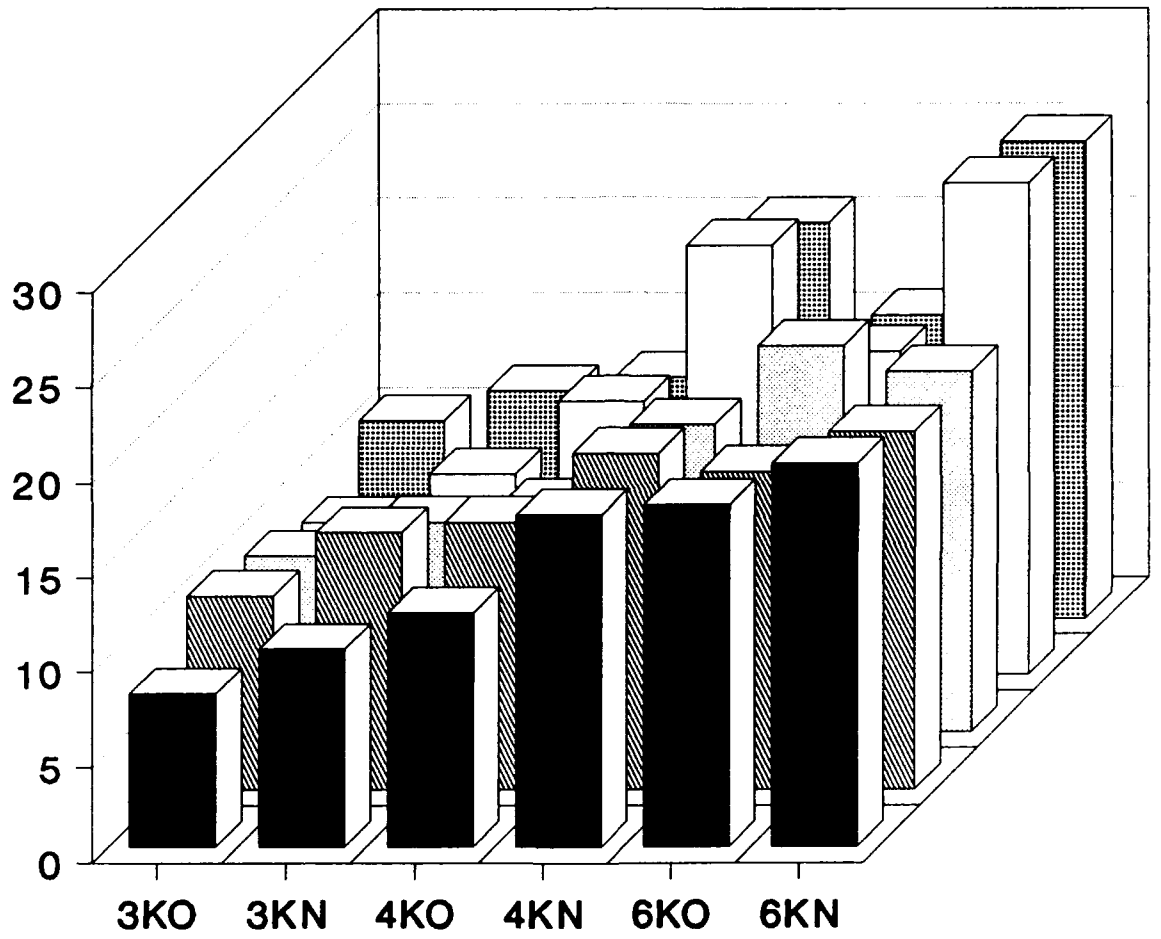
Frequency O=Oldest N=Most Recent

- LOS = 5-9yrs
- LOS = 10-14yrs
- LOS = 15-19yrs
- LOS = 20+yrs (all)

Hi Freq Analysis-No 1-4yr LOS

AT-RISK EVALUATION

RATE = GSM

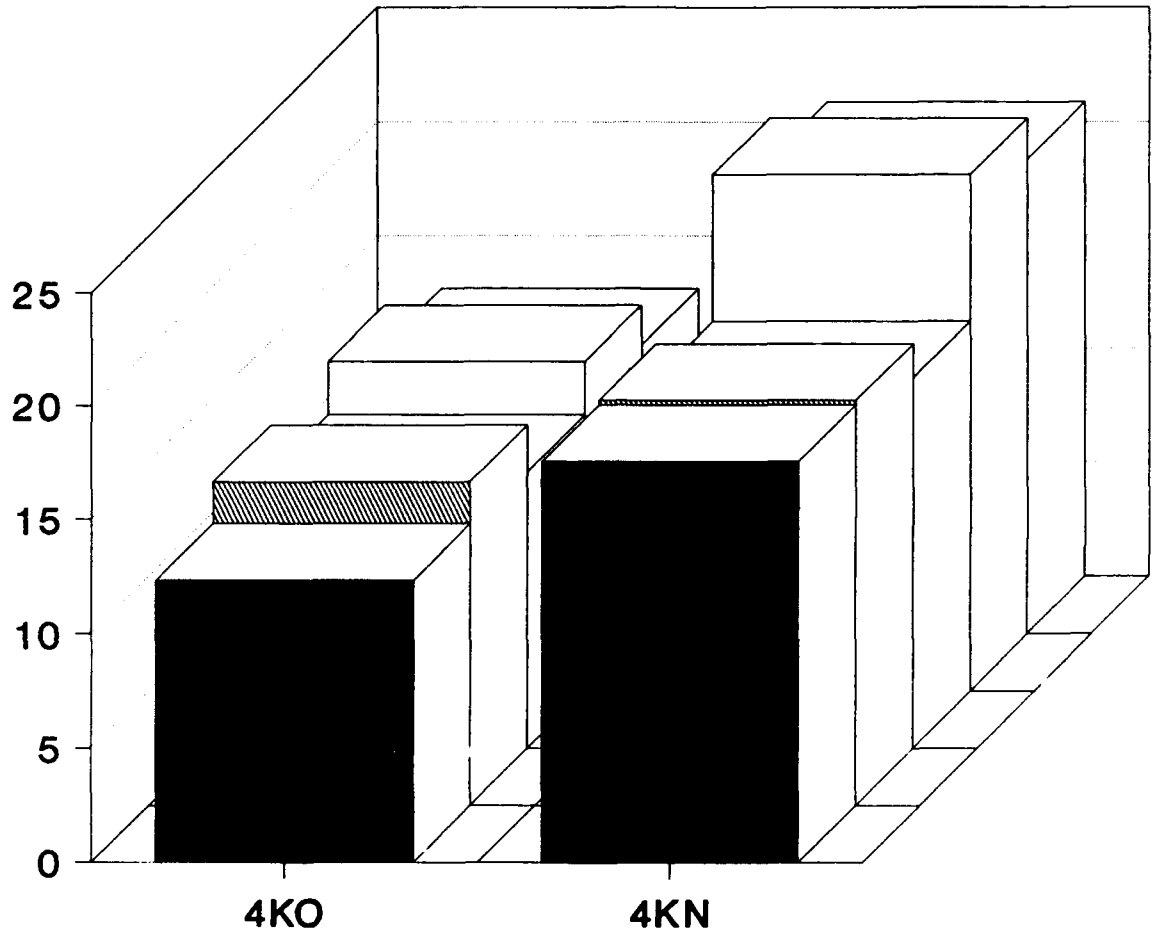


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all GMs)

High Frequency Analysis

AT-RISK EVALUATION
RATE = GSM

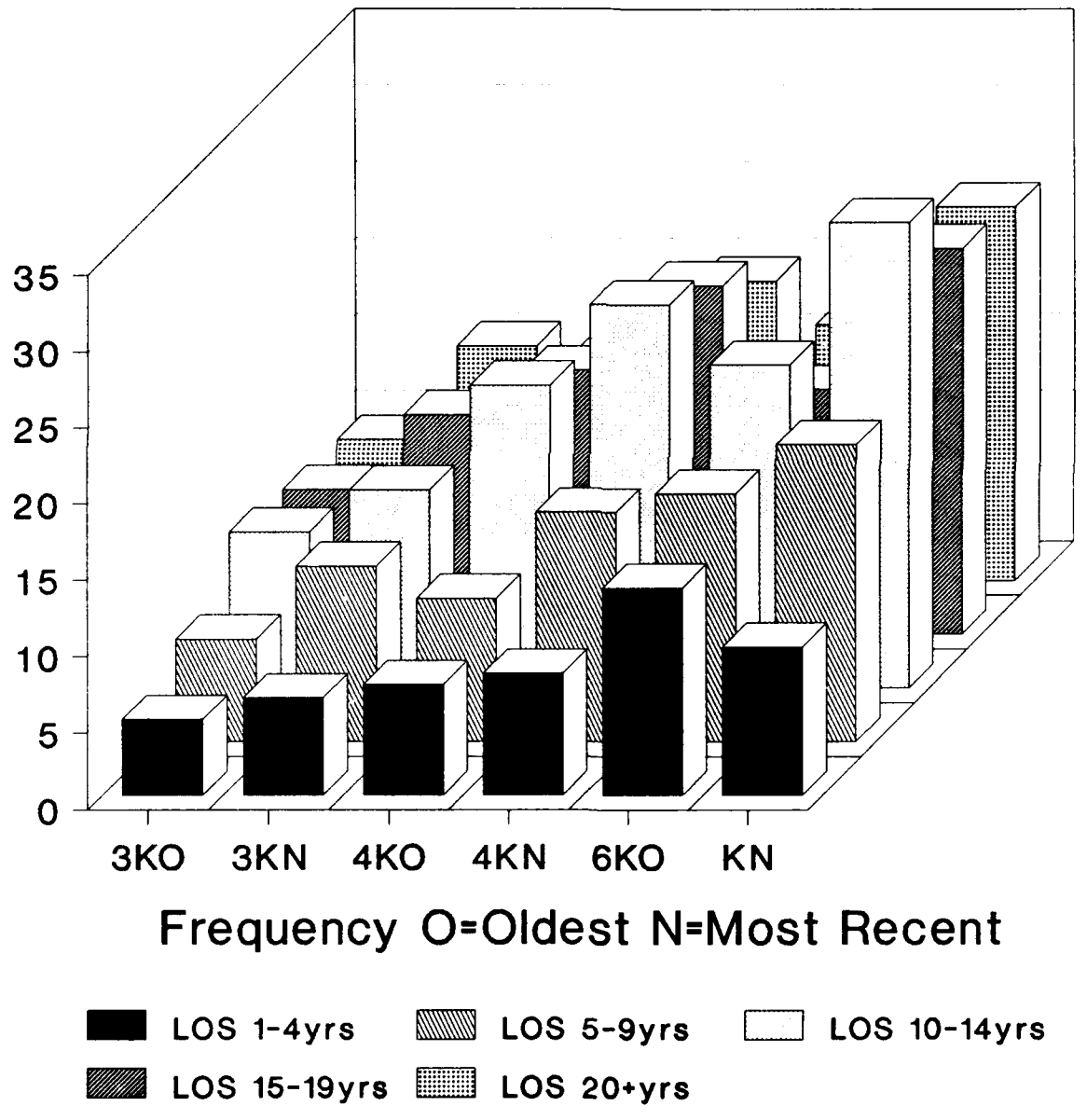


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all GMs)

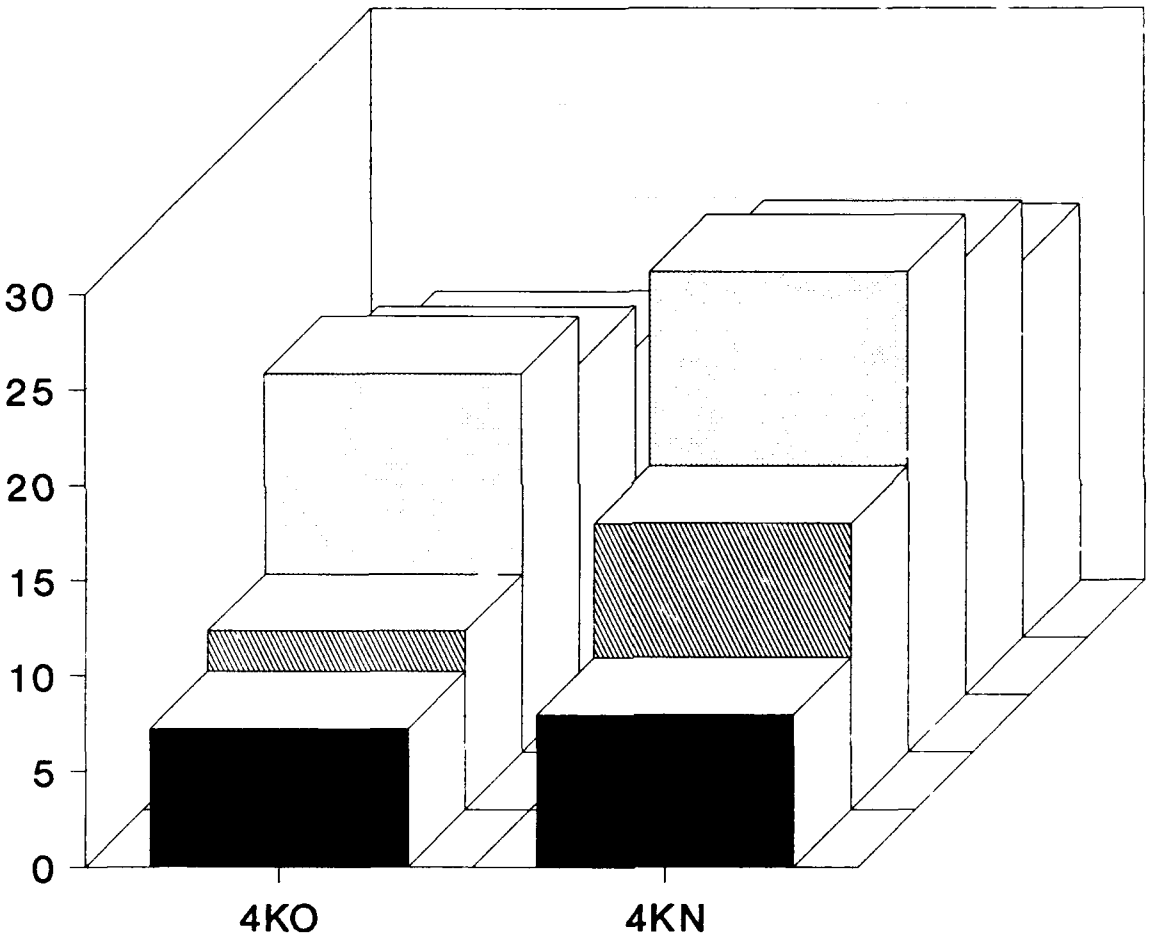
Hi Freq Analysis (No LOS 1-4yrs)

AT-RISK EVALUATION
RATE = HT



High Frequency Analysis

AT-RISK EVALUATION
RATE = HT

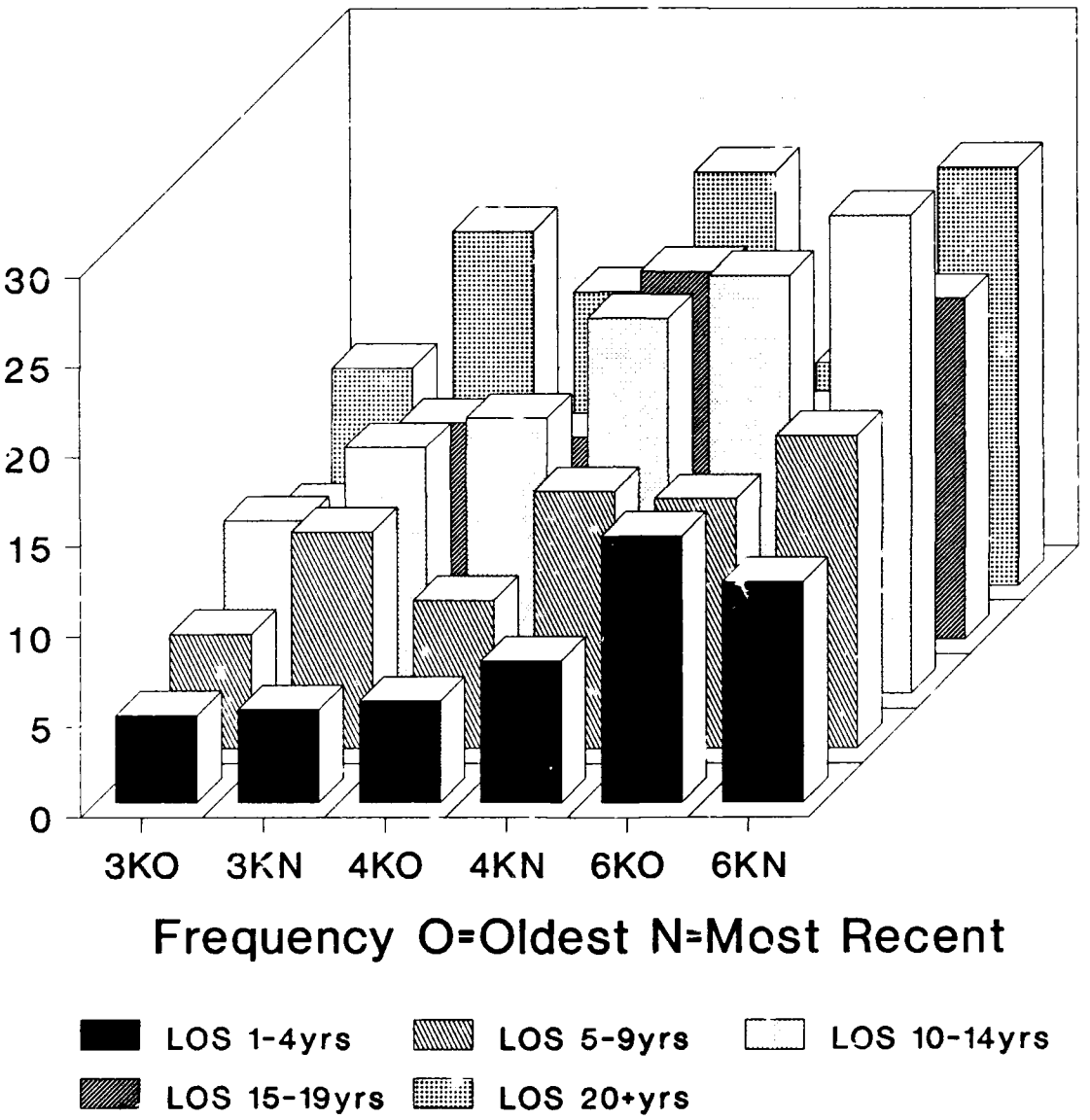


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

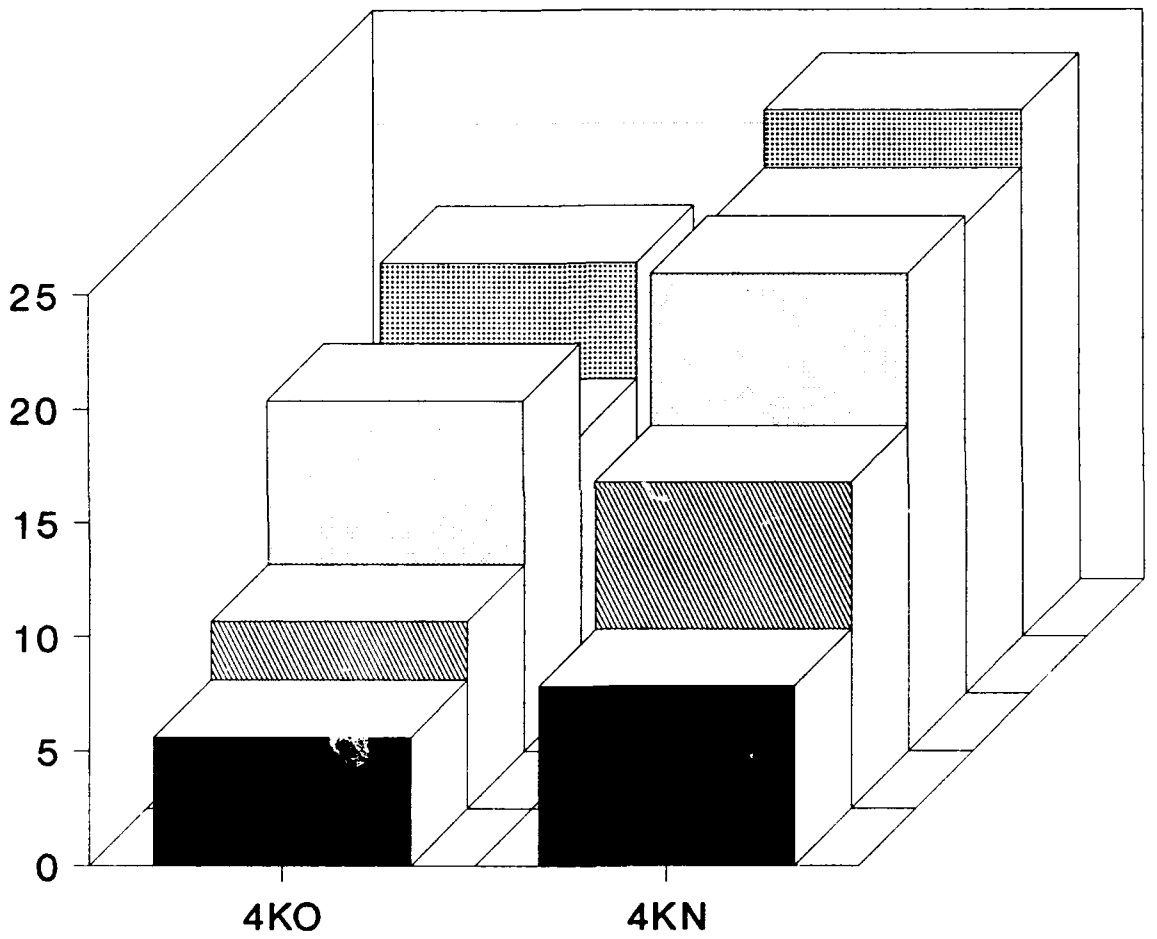
AT-RISK EVALUATION
RATE = MM



High Frequency Analysis

AT-RISK EVALUATION

RATE = MM



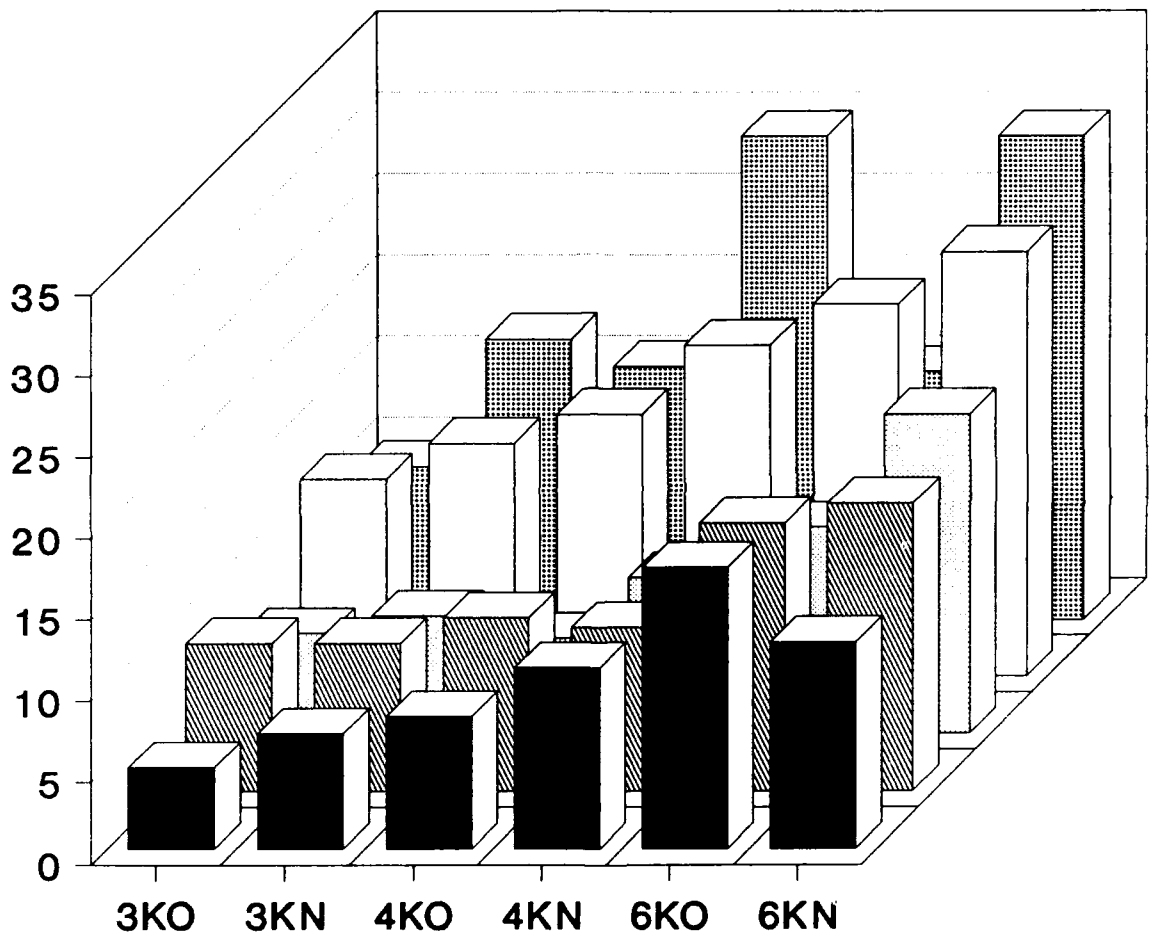
Frequency O=Old N=Most recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

RATE = MR

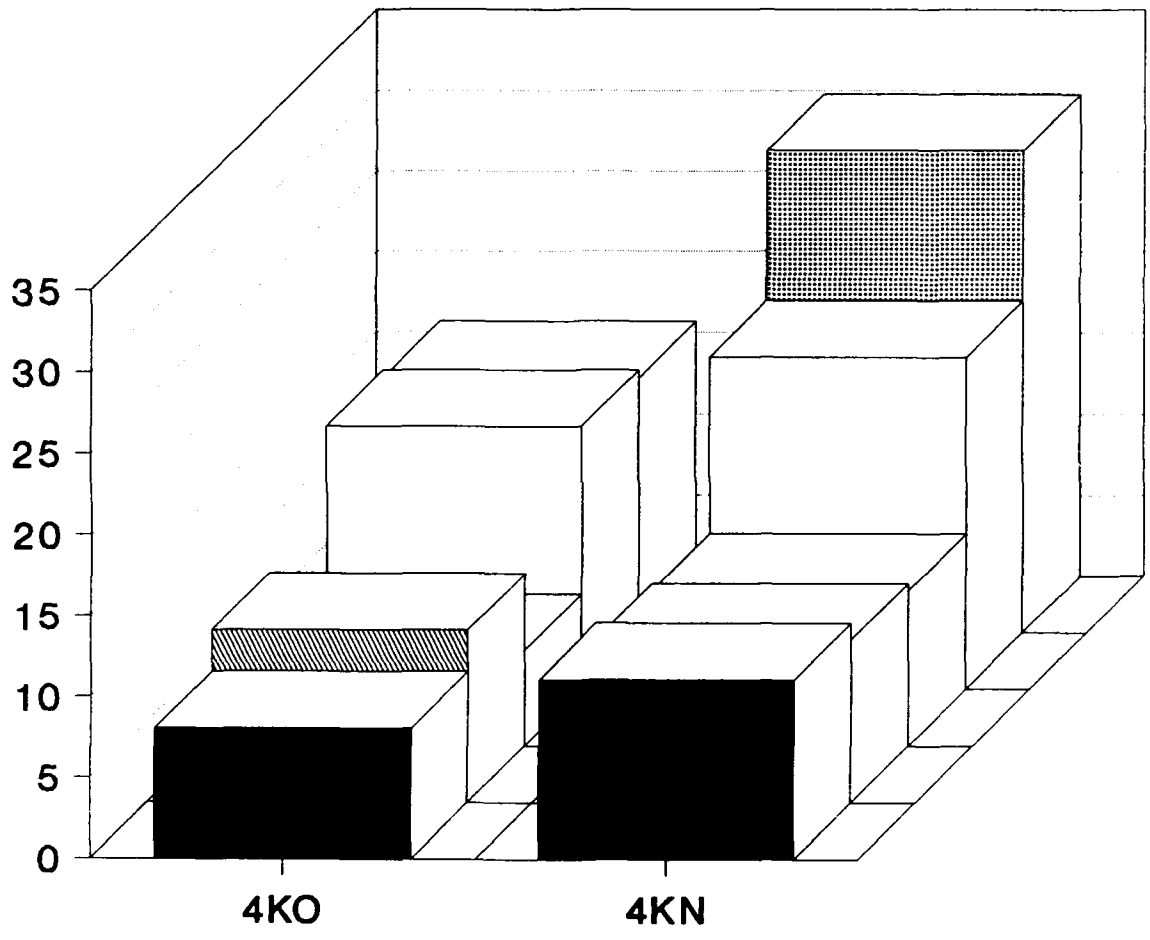


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION
RATE = MR

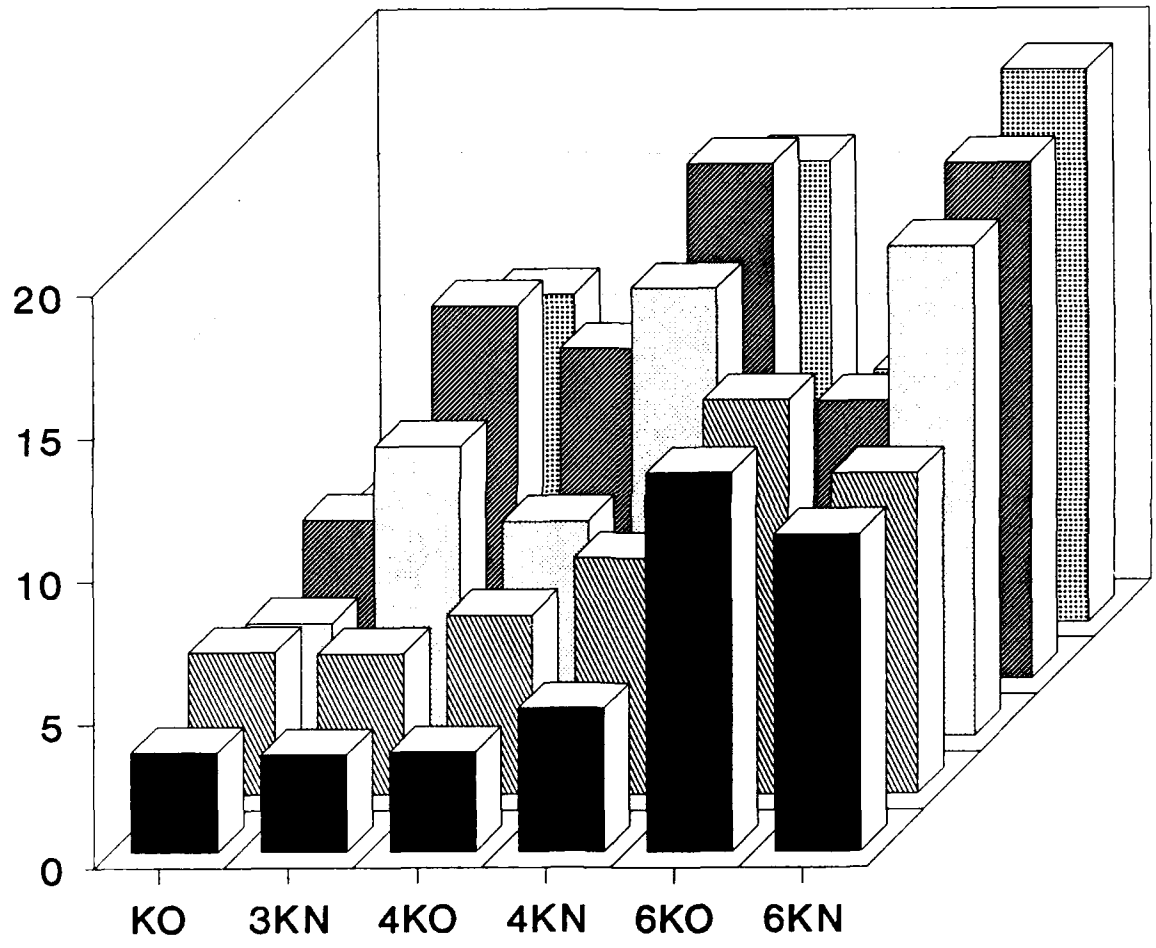


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

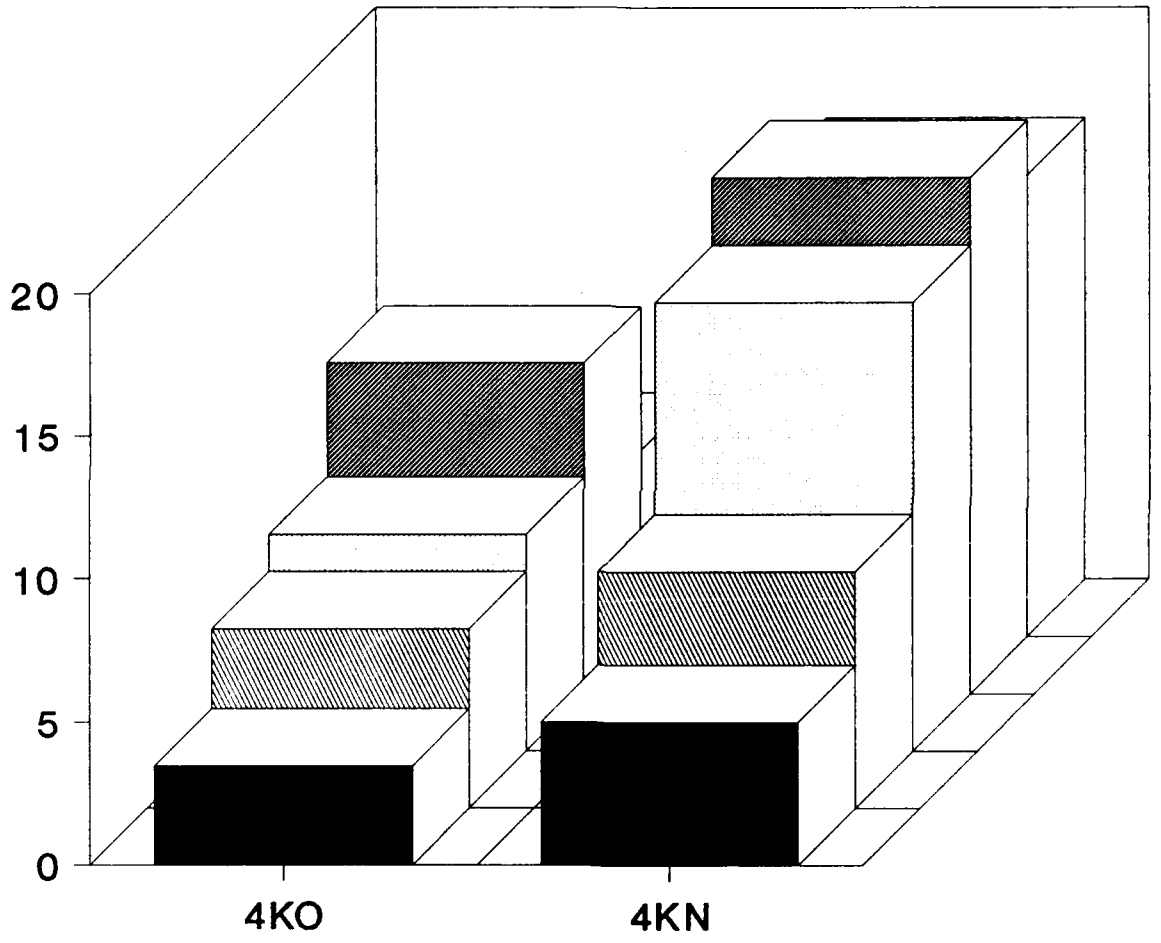
High Frequency Analysis

AT-RISK EVALUATION
RATE = MU



High Frequency Analysis

AT-RISK EVALUATION
RATE = MU



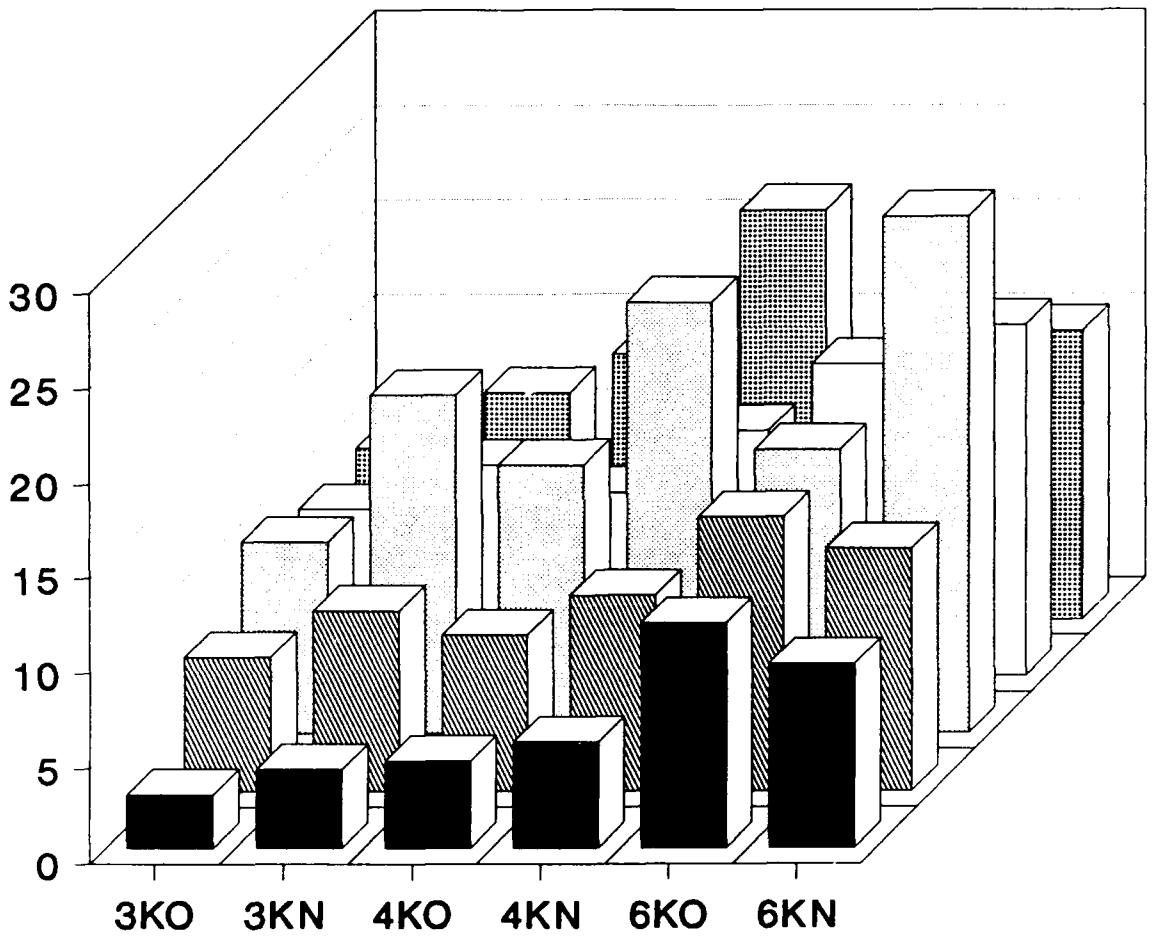
Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION

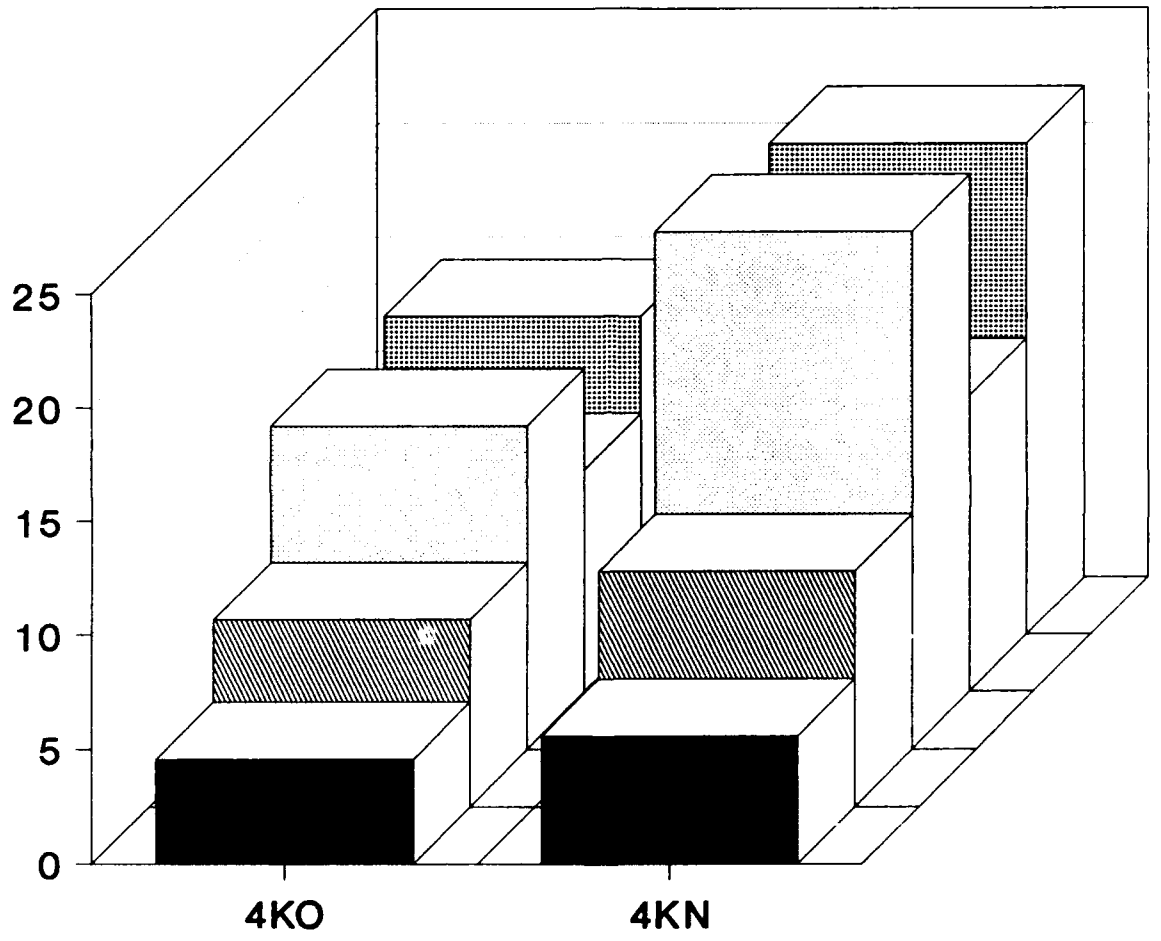
RATE = RM



High Frequency Analysis

AT-RISK EVALUATION

RATE = RM

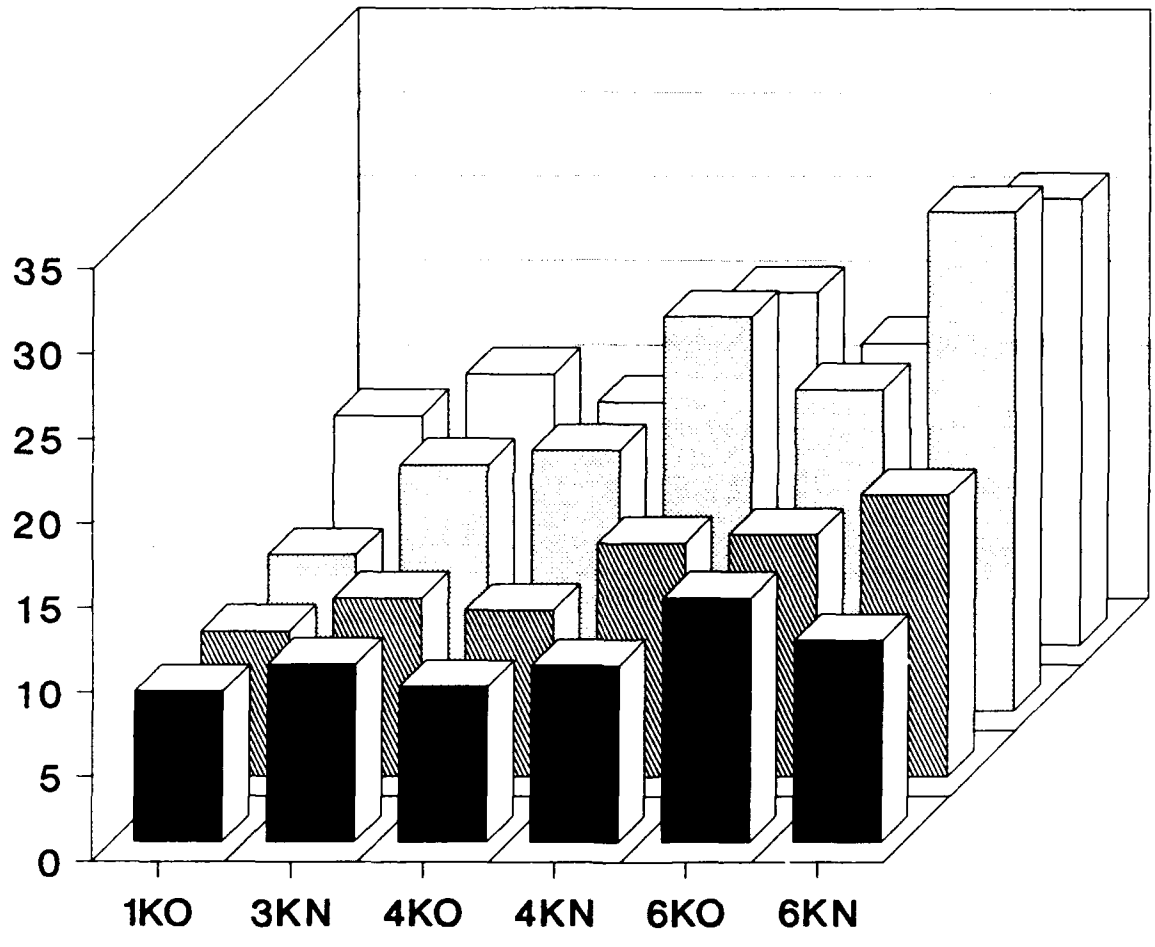


Frequency O=Oldest N=Most Recent

LOS 1-4yrs
LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs

High Frequency Analysis

AT-RISK EVALUATION
RATE = STG

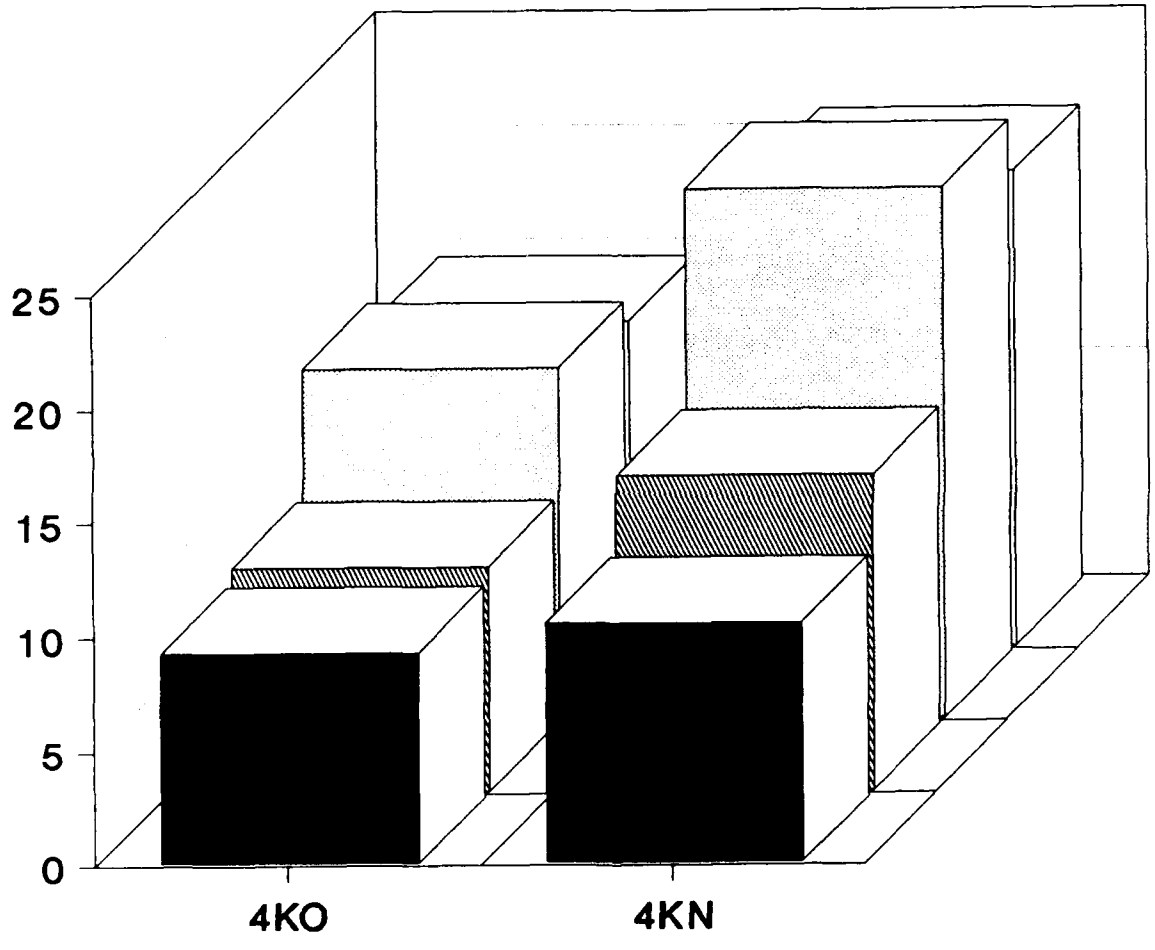


Frequency O=Oldest N=Most Recent

LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all STs)

Hi Freq Analysis (No LOS 1-4yrs)

AT-RISK EVALUATION
RATE = STG

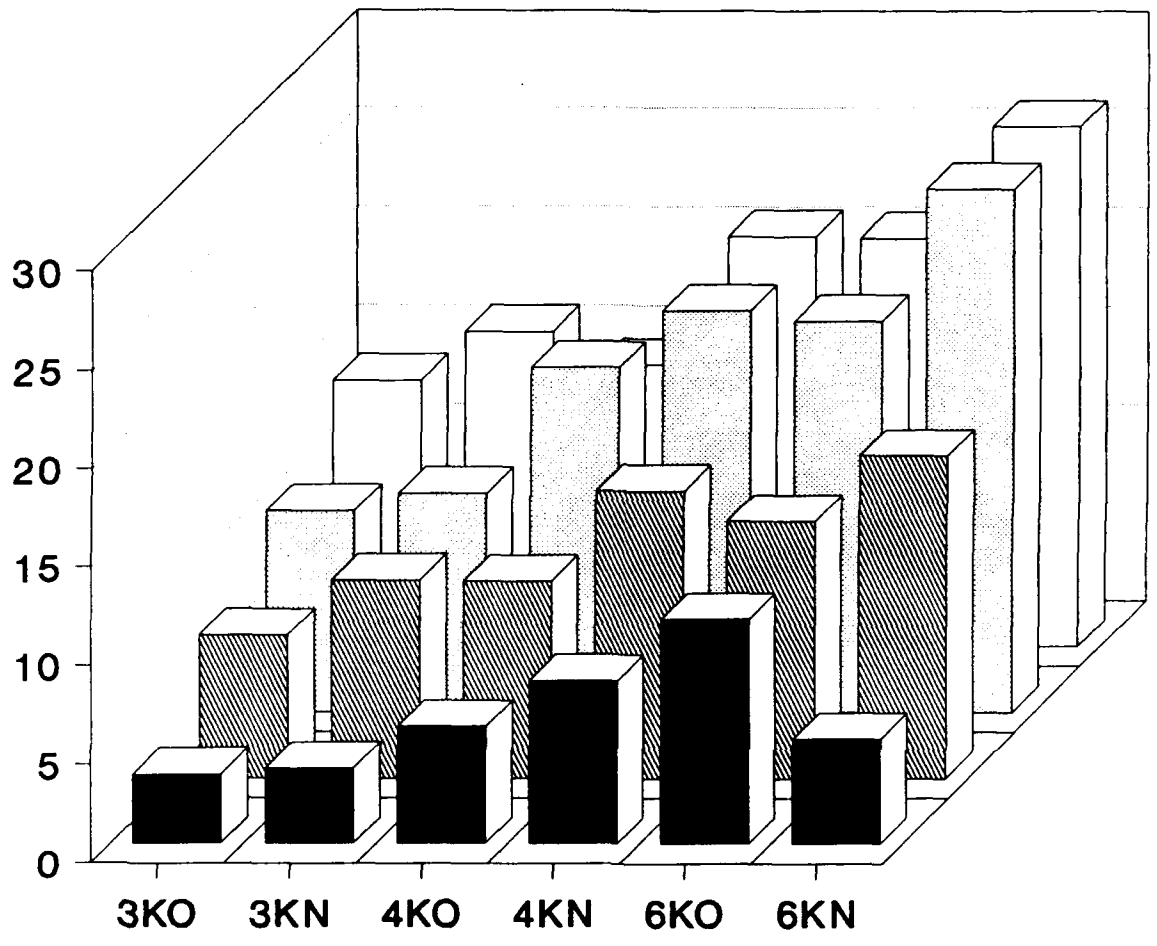


Frequency O=Oldest N=Most Recent

LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all STs)

Hi Freq Analysis (No LOS 1-4yrs)

AT-RISK EVALUATION
RATE = STS

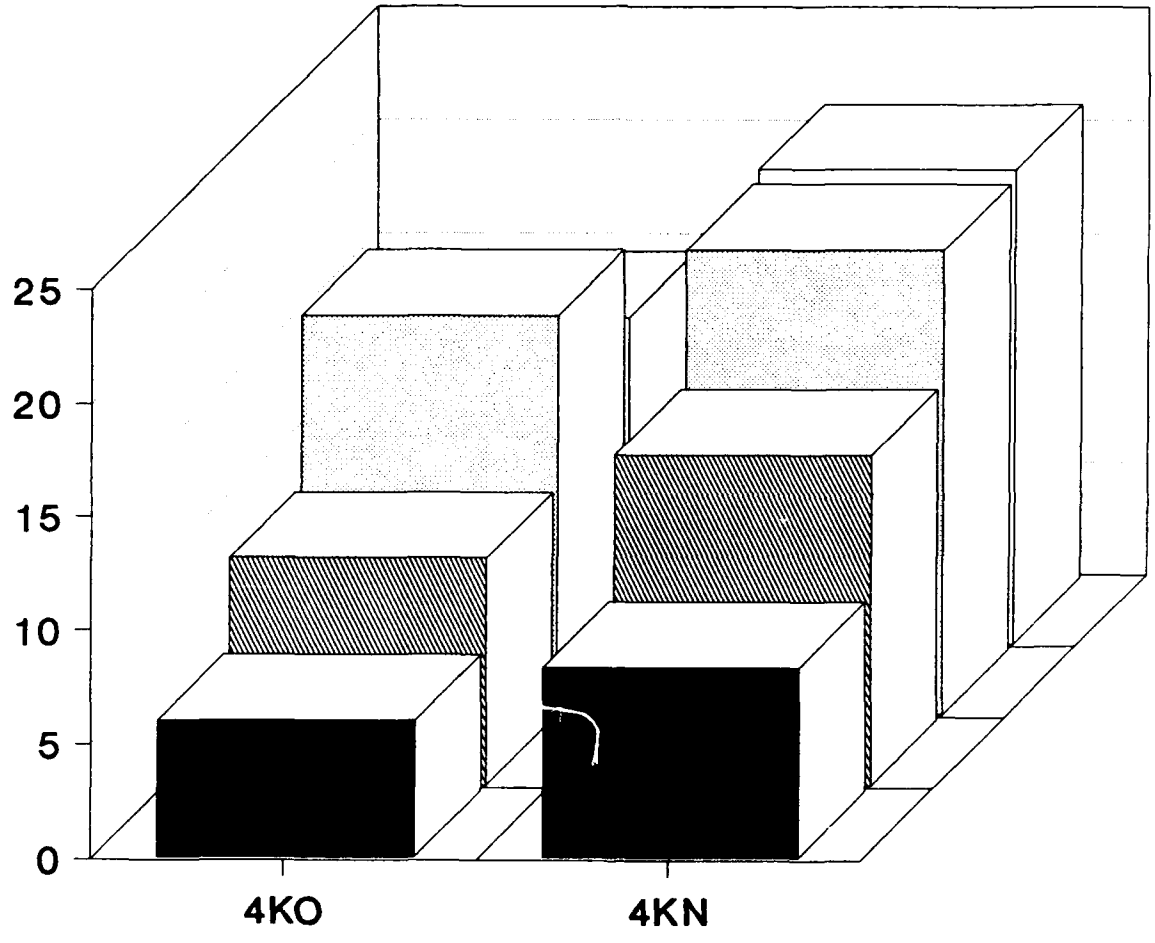


Frequency O=Oldest N=Most Recent

LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all STs)

Hi Freq Analysis (No LOS 1-4yrs)

AT-RISK EVALUATION
RATE = STS



Frequency O=Oldest N=Most Recent

LOS 5-9yrs
LOS 10-14yrs
LOS 15-19yrs
LOS 20+yrs (all STs)

Hi Freq Analysis (No LOS 1-4yrs)